The Dock and Harbour Authority

No. 260. Vol. XXIII. Edited by BRYSSON CUNNINGHAM, D.Sc. B.E., F.R.S.E., M.Inst.C.E. JUNE, 1942

CONTENTS

Editorial Comments

New Orleans.

Nearly two decades have passed since a descriptive notice of the Port of New Orleans appeared in this Journal. Much has happened in the interval: developments in various directions have taken place and substantial progress has been made, so that we are sure our readers will welcome the article in this issue on the present position and outlook of the port which has been officially prepared by Mr. Scott Wilson, Public Relations Counsel of the Port Authority, to whom our warm acknowledgments are tendered.

The article furnishes detailed particulars of the trade and shipping activities of a city, which, in the course of a couple of centuries, has risen from an insignificant riverside settlement to the exalted position of second port in the United States of America.

It had a modest and not very propitious beginning. It was founded in a region of densely-wooded swamps and marshes, with wide expanses of prairie land surrounded and intersected by streams, lakes and lagoons, which had been formed by the periodic inundations from the river Mississippi over tracts of its own alluvial deposits at its deltaic mouth.

As pointed out in the article, the destiny of the port is indissolubly bound up with the river on which it stands, and its prosperity is largely dependent on the treatment accorded to the latter. As in the case of the majority of rivers flowing into tideless seas, the mouth of the Mississippi is characterised by extensive alluvial accretions, which have the effect of creating shallows and reducing the depth available for navigation. In front of the city, the river is an imposing stream from 1,500 to 3,000-ft. wide, with depths varying from 60 to over 200-ft. A hundred miles or so downstream, this mighty volume of water disperses itself into the Gulf of Mexico through numerous channels of which it has been a matter of difficulty to maintain one or two in serviceable condition and with sufficient depth for the needs of modern vessels.

The problem of forming and maintaining a conveniently navigable mouth has engaged the attention of American engineers for considerably more than one generation. Writing in 1923 we summarised the story, which, with later developments, is somewhat as follows. As far back as 1875, steps were taken under authorisation from the Federal Government to provide a serviceable channel, 26-ft. in depth, for shipping through the South Pass by the construction of parallel jetties, which, it was expected, would concentrate and direct the scouring effect of the outgoing current. The constructional operations involved, which included the damming of a number of subsidiary outlets, were completed in 1881, and the channel, having attained the standard aimed at, has been subsequently deepened to 32-ft. and so maintained ever since, with the aid of some occasional dredging. Encouraged by this result, the authorities, since the beginning of the present century, have turned their attention to the South-west Pass and by similar measures of treatment have achieved an available depth in the channel of 35-ft.

Although these improvements have definitely eased the situation, yet the inherent drawbacks of a deltaic approach to the port have brought about the consideration of an alternative route to the sea via Lake Pontchartrain to the North of the city and separated from it by a narrow strip of land, which has already been pierced for the formation of an Industrial Canal. It would be quite feasible by a development of this canal to provide a deep water passage to the lake and thence to the Gulf of Mexico.

Altogether, the Port of New Orleans, with its numerous but complicated waterway approaches, presents an interesting problem to the maritime engineers of the United States, who have done, and are doing excellent work in providing the port with an efficient approach commensurate with the needs of its growing volume of trade.

A Single Level Canal Route for England.

In the May issue of this Journal, while commenting on an address given by a German technician on Future Port Policy in Germany, we called particular attention to his anticipation that there will be an increased use of inland waterways as a cheap means of communication, for which reason he emphasised that sea ports must be equipped to deal with more inland traffic.

Now, canals in this country, despite their undoubted good fortune at the outset, have for quite a century been languishing under a cloud. The railways, with their cognate interests, have gradually destroyed their effective use and brought them, or the majority of them, to the verge of bankruptcy. But the war has shown that there is a wide field of usefulness and economical service for canals, if only they are judiciously administered and worked on suitable lines.

Quite recently, Mr. John Miller, chairman of the Grand Union Canal Company, an undertaking conspicuous for its initiative and enterprise, claimed, at the annual meeting of the Company, the right of the canal industry to Government assistance and, above all, " encouragement " and " an assurance in some con-

Editorial Comments—continued

crete form that it had ceased to be regarded as a depressed industry for which there was no future." It was a matter of common knowledge, he said, that Germany, Belgium, France and, in recent years, Russia, regarded inland transport by water as of such vital importance that the money required for its development, amounting to millions of pounds, was readily forthcoming.

This is quite true, and only wilful short-sightedness can ignore the fact.

At this juncture, there appears a striking brochure, reviewed elsewhere in this issue, which presents the case for the construction of a great single-level canal throughout the length and breadth of England. At first sight, the project appears visionary and incapable of realisation, but facts and figures are adduced to show that the scheme is qnite practicable, provided the financial difficulties can be overcome.

One of the principal criticisms of the existing canal system of this country is that there are too many and too frequent changes of level in their routes, involving considerable delay at locks, as well as loss of water and other attendant inconveniences. The fact that a canal scheme has been devised, which will do away with this drawback in arresting, and calls for attentive consideration.

We are not in a position to confirm or question the data on which the scheme is based, but we do re-affirm our conviction that the time is ripe for a reconsideration of the whole subject of canal transport in this country on broad lines, so as to adapt and develop it to the best advantage in the national interest.

Port Health Authorities and the Risk of Epidemics.

A timely warning note was sounded at the annual meeting of the River Blyth Port Health Authority in reference to the possible danger of typhus carriers arriving from places abroad where, as in Eastern Europe, there has been frequent incidence of the disease due to war-time conditions.

The Port medical officer, Dr. John Stokoe, referring to the subject of anti-typhus precautions, said it was apparent that cases of typhus had occurred in North European and Mediterranean countries. He believed that there had been a number of cases in Berlin. A letter from the Ministry of Health had drawn attention to the risk of the importation of typhus into this country unless very rigorous measures were taken.

Every vessel, added Dr. Stokoe, which entered a British port from a Northern European or Mediterranean port, whether or not a satisfactory declaration of health was made, must be visited by the port medical officer and all crews and passengers must be examined before they disembarked. Where necessary, the Ministry advised enlisting the services of local practitioners to cope with the work.

The Authority decided to leave the arrangements in the hands of the chairman, the medical officer and the clerk. Similar steps, we understand, are being taken by other port health authorities along the North-east Coast. In a matter of this kind the importance of a vigilant watch can scarcely be over-rated and it is satisfactory to know that port health officers are keenly on the alert.

The Minister of War Transport and Port Efficiency.

As reported on another page in this issue, the Minister of War Transport has made an official statement in the House of Lords on the work of his Department in supervising the allocation of ships to suitable ports of discharge, and on the arrangements made whereby incoming cargoes can be handled promptly and expeditiously, including transmission, where necessary, by internal transport and by coastwise shipping.

It is quite true, as Lord Leathers remarked, that the docks of this country are the nodal point of its transport system. Everything hinges on their efficiency and smooth working. Accordingly, it is satisfactory to have the assurance that the establishment of dock labour schemes has really proved effective to this end; that unauthorised stoppages of work, which formerly were painfully frequent, are now rare, and that shortages of labour created by men refusing particular jobs, have ceased. It is to be hoped that the "minor difficulties," which the Minister admitted were "constantly cropping up," will find equally satisfactory adjustment.

But a rather biting commentary on the Minister's optimistic outlook is forthcoming from recent news that, at a North-east Coast port, troops have had to be called in to unload an urgent cargo in consequence of the dockers going on unofficial strike for increased pay, notwithstanding the fact that, generous rates are now in force; indeed, some of the men are stated to have been earning over £10 per week!

Such sporadic outbreaks against order and discipline are not only irritating: they are dangerously detrimental to the National safety and should be suppressed with an iron hand.

"Measured Mile" Posts.

The announcement in the press that three "measured mile" posts, situated on the North-east Coast, a little to the north of the River Tyne, have been dismantled and removed, calls attention to a feature of coastal and riverside scenery familiar enough to mariners, but not always intelligible, nor often recognised by the general public. Such posts, arranged in pairs at a distance apart, normal to the water front, sufficient to ensure accurate alignment at the start and finish of a course of one nautical mile (6,080 lineal ft.), are to be found erected in the vicinity of river estuaries, where steaming trials of new vessels are accustomed to be held, and, accordingly, they are more or less associated with rivers on the banks of which shipbuilding yards are located, so as to enable the trials to be made under convenient conditions.

The Tyne posts are of particular interest in that their founder and custodian in the past has been the North-east Coast Institution of Engineers and Shipbuilders, the members of which have been largely responsible for the design and construction of the vessels for which the measured mile posts were provided. The date of the first erection of the ports is uncertain, but in 1885, following the report of a sub-committee of the Council, a set of four wooden posts was erected on a fresh site. These were replaced by iron, or steel, posts in 1895. Since their installation, many notable vessels have made use of them to test their speed capabilities, and though certain of the posts may, under present conditions, have proved redundant, they have all played an important part in building up the reputation of the Tyne as a great shipbuilding centre and their disappearance is to be regretted.

Another interesting point is that just before the commencement of the present war, day trials had been largely supplemented by night trials. Complaints had been made that hazy atmospheric conditions sometimes prolonged speed trials unduly. The lighting of the posts in the daytime did not altogether get over the difficulty: night-time illumination gave more satisfactory results, partly because the atmosphere was more frequently clear enough for sighting the posts and determining their alignment. At any rate, it is claimed that much expense was saved by the innovation and that ships were able to complete their tests without undue delay. Lighting has, of course, been discontinued during war-time.

Road Hauliers and Relief of Port Congestion.

The services rendered by road organisations on the clearance of goods from ports during times of crisis have not always received full recognition, and it is desirable that publicity should be given to a statement made by Mr. A. W. Darby at the annual luncheon of the East Midland Area, Associated Road Operators. Proposing the toast of "The Ministry of War Transport," Mr. Darby commended the voluntary principle in war-time service. The high spot of the success of the voluntary system, he said, was the remarkable clearance of the North-west ports. There was an example of very large supplies of material lying at those ports at a very critical time. Contact was established between the Ministry of War Transport, the district transport officer and A.R.O. representatives, and, with the good will of the operators in the area, in a very short time the material was transferred from a vulnerable area in the docks to safer districts.

"It has always been a matter of regret to me," Mr. Darby continued, "that the time and condition under which this work was carried out never permitted full publicity being given to this achievement nor fuller recognition granted by the bestowal of honours upon the Ministry staff for its great work. I hope the time will come when the full story can be told."

Water Front of New Orleans.

The Port of New Orleans

Second Most Important Sea Gateway of North America

By SCOTT WILSON.

Influence of River Traffic

TO many a United States citizen to-day, as to the world at large, the name, New Orleans, connotes a great river city and his thinking is likely to be in terms of New Orleans' relation to the Mississippi River. Truth is that, though literature has dwelt chiefly upon the commerce and romance of this mighty stream to the almost total exclusion of its position as a seaport, the Port of New Orleans in 1941 stands as the second most important sea gateway of North America.

That the Mississippi River and New Orleans' fortunate location upon its banks 110 miles from the Gulf of Mexico have been chiefly responsible for this, is not to be denied. Chroniclers of the Port, however, may wish that more attention had been given its ocean-going commerce throughout the years since the Sieur de Bienville founded the city in 1718.

Never more than at the present moment, when the river traffic is perhaps 50 per cent. over 1940's record tonnage (8,187,827 tons), is New Orleans status with reference to ocean trade routes, new and old, of more significance.

This factor, then, particularly in the light of Caribbean defence and trade developments that are rendering it the " Mediterranean of the West," deserves equal consideration with that of New Orleans' position as the traffic junction of the most extensive inland navigation system on the globe, a system embracing 13,000 miles of navigable waterways.

Commercial Statistics

Statistics of Port of New Orleans' commerce show that 1940 was the greatest year in its history. United States Engineer Department statistics reveal a total harbour tonnage of 19,795,599 " short " tons (i.e., 2,000 pounds) a gain of over 3,000,000 tons over the preceding years, in which 16,304,530 tons were handled at the port. Valuation of 1940's cargo tonnage was over 325 million dollars, an aggregate which placed the port second in the nation as a general cargo seaport.

Commerce of New Orleans in 1940 was divided as follows:—

	Tons
Imports	2,896,269
Exports	3,351,177
Coastwise, shipments	3,554,571
Coastwise, receipts	1,811,755
Internal receipts	5,240,960
Internal shipments	2,940,867

In the first half of 1941, the influence of the war made itself felt in the port even more strongly than during 1940 and no phase of shipping but reflected such effects. While shortage of ship bottoms brought some decline as in export tonnage, there were notable gains, as in imports. During the first six months of 1941 there was a gain of 99,349 tons in this classification; totals for first half of 1941 being 1,430,975 tons as compared to 1,331,626 for 1940. Far Eastern and Latin American trade brought this growth.

Comparisons with Atlantic and Pacific Coast ports in relative tonnage valuations for 1941 indicate that New Orleans was better able to maintain its position than any other, with percentage of decline considerably less than most of the ports.

Certain trends in trade made themselves felt increasingly in 1941 at the Port of New Orleans. Healthiest and most vigorous among these were the growth of Latin American business through the port and an amazing increase in internal waterways traffic, not only upon the Mississippi River, but along the Gulf Coast Intracoastal Canal, which stretches from Corpus Christi, Texas, to St. Marks, Florida, and upon which New Orleans is the central distributing point.

Port of New Orleans—continued

The figures for Ibero-American trade at New Orleans present an interesting picture. In 1939, there was an export business valued at $54,083,173 with Latin American countries, United States Department of Commerce statistics show. In 1940, this jumped to $56,035,582, a gain of $1,952,409. In 1939, the imports amounted to $56,377,745, while in 1940 this had spurted to $60,116,317, or an increase of $3,738,572.

Upon the inland waterways the gains were even more phenomenal. There were 5,855,666 tons of goods handled in and out of New Orleans internally in 1939; in 1940, this had grown to 8,181,827. But 1941 has made this seem almost small. Barge lines report increases in tonnages ranging as high as 100 per cent. in some instances and it is safe to say that a very considerable percentage of growth will be perceived when the figures for the year are available.

Quayside Shed Housing Bags of Green Coffee.

In passing, it is worth while to note one or two interesting points about this river traffic to and from New Orleans. Definitely established as a major trade movement is the strengthening North-south flow of goods as contrasted with the East-west movements which end in the Atlantic Coast ports. One single cargo which may be taken as reflecting this is the carrying of new automobiles by river barges; in the past two or three years this business, aided by development of special type barges to handle this comparatively light but bulky and valuable cargo by frames of steel which permit hauling of nearly 300 per barge, has burgeoned enormously.

Another commodity showing great gains in tonnage movements through the Port of New Orleans via river and canal, is oil. The defence movement has chiefly accounted for this trend.

Still more interesting is the fact that New Orleans has been the focal point for large rubber shipments in the past year. More tyre and rubber factories in the mid-west, plus the needs and other influences of the National Defence programme, have brought this about.

Location and Trade Area.

Some description of the port's location and of its trade area is also worthy of note.

New Orleans occupies both banks of the Mississippi River in the State of Louisiana at longitude 90 degrees, 04 minutes, 09 seconds; latitude 29 degrees, 56 minutes, 59 seconds. It is bounded on the North by Lake Pontchartrain, and has access to the Gulf of Mexico through the river and, for small vessels, through the lake. Limits of the port, fixed by United States statutes, give the Port a present total water frontage of 135 miles; 50 miles on the river and the remainder on Lake Pontchartrain, Lake Borgne, and the Industrial Canal.

The entrance to the Port of New Orleans from the Gulf of Mexico by way of the Mississippi River is through South Pass or Southwest Pass.

South Pass is 13 miles long and 750-ft. wide. At the Gulf entrance, the channel is 32-ft. deep, with a least width of 200-ft. and 30-ft. deep with a least width of 550-ft. The distance to New Orleans from the Gulf is 107.5 miles by way of South Pass.

Southwest Pass is 19.8 miles long, 35-ft. deep, has a maximum width of 2,400-ft. and minimum width of 1,190-ft. To New Orleans from the Gulf by way of Southwest Pass is 114.5 miles. This pass is 27 miles West of South Pass, 160 miles West of Mobile and 330 miles East of Galveston.

The river has ample depth to accommodate the largest vessels afloat, ranging in low water stages from 30 to 60-ft. near the banks to depths of 100, 150 and 180-ft. in midstream. It is about three-fourths of a mile in width.

The Intra-Coastal Canal crosses the Mississippi River at New Orleans. Vessels entering the port from the East, using the Intra-Coastal Canal, pass through the Mississippi Sound, Lakes Borgne and Pantchartrain and the Inner Harbour Navigation Canal. An alternate route is through Lake Borgne and Lake Borgne Canal which enters the Mississippi River a short distance below the city. Those entering the river from the West pass through Harvey Canal or Company Canal. These canals connect the river with the many bayous, lakes and canals of South-west Louisiana. These routes are at present limited to vessels of shallow draft.

Tides

No tides reach the harbour. At the mouth of the river there is a tide of not more than 2-ft. The maximum seasonal difference between high and low stages of the river is 20-ft. at New Orleans.

Weather Conditions

The waters of the Port of New Orleans are navigable throughout the year. Ice is unknown. The mean annual temperature at New Orleans is 68 degrees; for the coldest month, January, it is 54.5 degrees. Occasionally fogs occur in the spring and winter months in the Gulf and the river; Southerly and Easterly winds bring them, Northerly and Westerly winds carry them away.

The prevailing winds are:

Northerly—January and December.
North-easterly—February, September, October and November.
South-easterly—March to July, inclusive.
South-westerly—August.

The annual rainfall averages 60-in., which is well distributed throughout the year.

Hinterland

Northward, in what is known as North America's "Mid-Continent Area," lies the trade region of the Port of New Orleans, a vast territory of over 30 states, comprising over 50 per cent. of the United States population. In this broad valley also are found nearly 80 per cent of the nation's crops and from 70 to 80 per cent. of its mineral wealth lies buried here.

The advantages appertaining to New Orleans by virtue of its position as the mouth of this great funnel through which flows almost unlimited production, can be appreciated by glancing at commodity transportation costs of one or two items.

Under normal conditions, cost of moving flour from New Orleans to Australia, a distance of 11,000 miles, is about 45 cents. per hundred pounds. Grain moves from St. Louis to New

Port of New Orleans—continued

Orleans on the river, a distance of over 1,000 miles, for about 50 cents. per ton, or 2½ cents. per hundredweight.

Nothing better reveals the importance of new trends in North American trade than the fact that this up-river region brought New Orleans and other gulf ports a traffic increase in 1939 of 85 per cent. over previous peak year of 1929, while the Atlantic and Pacific ports showed a loss of one per cent. and 16 per cent. respectively.

Leading Officials of Port of New Orleans. Left to right: E. A. Stephens, President of the Board of Commissioners of the Port; Lester F. Alexander, Vice-President (pointing); E. O. Jewell, Director of Commerce for the Port; and Colonel Marcel Garsaud, General Manager of the Port.

In defence precautions for this important Port of New Orleans, the United States Navy, of course, plays an important part. Attention has been given to the city and a growing number of naval stations of various sorts indicates realisation of its importance, as well as need for protection and advantages as a base, advantages pointed out 50 years ago by the late Admiral Mahan.

In addition, the Port Commission of New Orleans is urging even greater protective measures, meanwhile taking cognizance of Army bomber bases in the city and near by.

This, as well as construction of a supplemental ocean vessel outlet to the sea, was advocated recently by E. A. Stephens, President of the Board of Commissioners, Port of New Orleans, at the Mississippi Valley Association Convention in St. Louis, Missouri.

"Not only should the mouth of the river be strongly fortified," said Mr. Stephens, "but the groundwork for another outlet to the sea must be laid."

Port Facilities

The port plant of New Orleans consists of both privately and publicly-owned facilities. There are a total of 89 wharves, covering more than 11 miles of waterfront. Of these, the State of Louisiana owns 37, which were built and are operated by the Board of Port Commissioners; the United States Government owns 7; the railways own 19 wharves and one slip; and the remainder are owned or operated by private interests.

All wharves are parallel to the river bank, which permits ease and rapidity in docking, loading, and discharging, as well as saving in tug usage.

Publicly-owned facilities in the Port of New Orleans summarised:

	Feet
(a) On Mississippi River:	
General Wharf front	28,816
Of this, sheds front	23,853
Open area, sq. ft.	1,492,264
Shed area, sq. ft.	4,100,086
(b) On Inner Harbour:	
General Wharf front	2,400
Of this, shed front	2,380
Open area, sq. ft.	162,310
Shed area, sq. ft.	476,000
(c) Public Cotton Warehouse:	
Shed front	1,512
Wharf front	2,012
Open area, sq. ft.	154,587
Shed area	326,869
Warehouse storage capacity, H.D., B.C.	461,856
Sea delivery cap., day	7,500
(d) Grain Elevator:	
Wharf front	2,095
Shed front	340
Open area, sq. ft.	60,280
Shed area, sq. ft.	40,273
Grain storage, in bu.	2,622,000
Sea delivery, hourly	100,000

In all, there are slightly more than 7 miles of publicly-owned wharf frontage, with nearly 5.5 miles of shed frontage, behind which are approximately 5 million square feet of covered area for cargo in transit. This is in addition to the storage space for cotton, grain and bulk commodities.

Port Offices Building, New Orleans.

Private Facilities

The public-owned port plant by no means constitutes the whole of the New Orleans facilities. Private facilities are both varied and modern and handle considerable tonnages.

Four railroads have extensive river-front facilities and 30-odd private and chiefly industrial wharves handle manufactured products directly to and from river, inland canal, or sea vessels.

Important among government facilities of the port is the Army port of embarkation base, with a 1,079-ft. wharf that is now being greatly enlarged. Supplies for troops training in southern states are handled here, as well as being hauled to the Caribbean Islands for posts and military bases there.

The commerce of the entire port is served by 11 railroads and by 13 inland waterway and intracoastal canal boat and barge ser-

Port of New Orleans—continued

vices and half-a-dozen intercoastal and intracoastal steamship services.

Normally, nearly half-a-hundred freight-forwarding agencies serve foreign commerce, with as many cotton merchants having offices in New Orleans, and about a score of freight brokers and forwarders.

Handling Sisal Cargoes.

Adequate general and special commodity warehouses of private ownership, in addition to private cotton warehouses with more than 700,000 bales capacity, round out the picture of private port facilities, one that is not, however, static, as additional facilities, ranging from equipment to new buildings are announced from week to week.

Among outstanding developments of the past year or so have been location of important new industries upon the Port's inner harbour navigation canal, commonly known as the Industrial Canal.

Inner Harbour Navigation Canal

The Inner Harbour Navigation Canal crosses the City of New Orleans and connects the Mississippi River with Lake Pontchartrain, an arm of the Gulf of Mexico. This canal is five-and-a-half miles long, 30-ft. deep and is being dredged gradually to a bottom width of 500-ft. In the spring, the water of the river is about 20-ft. higher than that of the lake, necessitating a lock. This lock, near the river entrance, has a usable length of 640-ft., 75-ft. width, and 31.5-ft. depth. Vessels are locked through either way in about 20 minutes.

Four bascule bridges span the canal. The Florida Walk, Gentilly and Seabrook Bridges each have a clear span of 100-ft. At the south end of the lock is the St. Claude Avenue bridge with a span of 75-ft.

The canal was created primarily to provide deep water frontage for unlimited industrial development, and to provide the port with an inner harbour in which the commercial wharf system could be extended with the advantage of a constant water level.

The Port Commission own all lands bordering the canal. Industries may lease from the commission these waterfront lands.

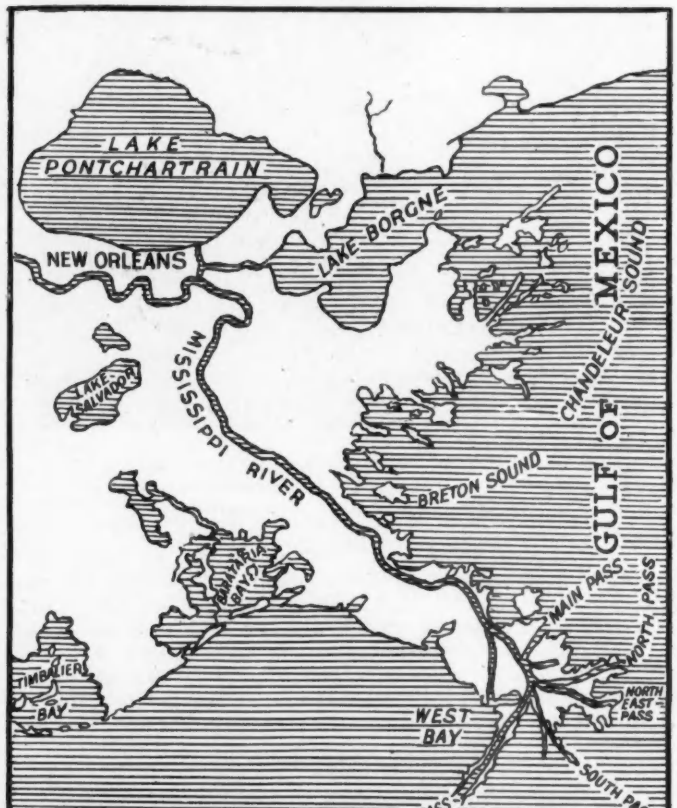
The largest new industry to be installed upon the Industrial Canal in the past year has been the Delta Shipbuilding Company, formed to build Liberty ships under the government's defence programme. With six ways and contracts to build some 33 vessels, the yards at the time of writing are looking towards making their first launching early next year.

Also located upon the Canal, Alexander Shipyards, primarily engaged in building of tugs and barges, have been expanded, and purchases by both the U.S. and Canadian Governments of seagoing tugs from these yards have pushed them to capacity output.

At the time of writing, still another shipyard is in process of being located upon the port's Industrial Canal. This is the Pendleton Shipyards, Inc., which will, as its first contract, build six ocean-going tug boats for the United States Maritime Commission.

Each vessel is to be an identical tug 195-ft. long, 37-ft. beam, with full equipment, including Diesel electric generating sets, electrically-driven pumps, and two main Diesel engines, turning 2,250 horse-power. The first of these tugs is scheduled for delivery in July, 1942.

Traffic through this Canal in 1941 reached highest point in history. Since it serves as eastern outlet to the Intracoastal Canal reaching to Mississippi, Alabama, and Florida, barge traffic, especially of oil, was particularly heavy.



In fact, so heavy has been the commerce destined for the Intracoastal Canal that the Board of Port Commissioners of New Orleans has advanced for the United States Engineer Department's consideration a project for alleviation of the situation through change and improvement of part of the route.

Government of the Port

A board of five commissioners, appointed by the Governor of the State of Louisiana for overlapping terms, governs the Port of New Orleans under provisions of state law. New statutes and

Port of New Orleans—continued

amendment to the state constitution instituted for the express purpose of improving administration of the Port, provide, it is believed, that it will never be subject to " political " regulation and that rigid civil service merit system shall apply to employed personnel.

Progressive attitudes adopted by the present Board of Commissioners have pushed Port affairs forward and out of stagnation into which they seemed headed for a time. Taking as their motto, " Service to Port Users," the Board has sought to handle management with full realisation of the responsibilities, as well as the privileges, of its position as one of the nation's chief seaports.

Important in the work of the present port commission has been a new department of the administration, instituted by this Board. This is a Department of Commerce, with its functions primarily those of customer service and business solicitation.

Mr. E. A. Stephens, Buick Motors executive and a prominent figure in New Orleans civic affairs, heads the Board of Commissioners as President. Mr. C. A. Bertel, cotton warehouseman, is secretary. Other members of the Board are Messrs. Lester F. Alexander, shipyards owner; A. B. Freeman, manufacturer; and Pendleton Lehde, architect and engineer.

The chief executive for the Port Commission is Colonel Marcel Garsaud, the general manager. By profession, Colonel Garsaud is a supervising and construction engineer who has specialised in port facility building and direction. In the first World War, he served in the United States Army as a Colonel of Engineers.

Legal Notes

Action against Port Authority for Damage in consequence of Submerged Wreck

A case, in which a claim for damages for alleged breach of duty by the Port of London Authority, as a consequence of which the motor ship *Jersey* received damage through fouling a submerged wreck in Sea Reach, River Thames on January 8th, 1941, was concluded in the Admiralty Court at the end of April.

The case was heard by Mr. Justice Bucknill sitting with two Elder Brethren of Trinity House. Evidence was given *in camera*, but the following judgment, for the report of which we are indebted to *Lloyd's List*, was given in open Court. Mr. F. A. Sellers, K.C., to whom reference is made, was leading Counsel for the Defendants.

Mr. Justice Bucknill, said the *Jersey* was coming to anchor off Southend when she struck a submerged wreck and suffered damage. Those in charge of the *Jersey* said that the wreck was not marked and they had no warning or notice of its existence. Defendants, they alleged had failed to see that the waters were safe and, further, did not warn plaintiffs.

Plaintiffs' evidence would appear to establish a *prima facie* case against the defendants. Mr. Sellers had argued that the damage was caused by the negligent navigation of the *Jersey*, but his Lordship accepted the evidence of those in charge of the *Jersey* that the vessel did not have any warning of the presence of any buoy to mark the wreck. The *Jersey* received instructions to proceed to an authorised anchorage and the question was whether the pilot of the vessel was negligent.

Mr. Justice Bucknill said he had discussed the matter with the Elder Brethren and they had advised him that the *Jersey* was not negligent in making a turn in the anchorage in the absence of any order or notice of a submerged wreck in the area. He agreed with the Elder Brethren and decided this point in favour of the plaintiffs.

Another point taken by Mr. Sellers was that the defendants had no duty towards plaintiffs so far as warning them of a submerged wreck was concerned, and the plea in the defence was that the jurisdiction of the Port of London Authority has been taken over for the time being by the Naval Control in this area. Mr. Sellers' argument was that the defendants had, in fact, taken reasonable care so far as the wreck was concerned by giving warning of its existence to the Naval Control, and they could not be expected to give any further warning.

His Lordship said, further, that in his view the arrangements made by the defendants were reasonable at the time. It was an arrangement which could tend to produce the most satisfactory marking of wrecks, provided Naval Control carried out their part of it while they were in a position to do so. Defendants' attitude indicated no breach of duty towards plaintiffs. They were justified in assuming that Naval Control would give warning of any wreck, as they were in a better position to give the warning.

"I think," concluded his Lordship, "that this arrangement with Naval Control was a proper arrangement and in all the circumstances defendants have not failed to take reasonable care to mark the wreck or to warn plaintiffs of its existence. That being so plaintiffs have not succeeded in making out a case against defendants, in whose favour there must be judgment."

Judgment was entered accordingly for the Port of London Authority with costs.

Cargo Stowage and Handling

The Minister of War Transport on Efficiency of Control

In a recent speech in the House of Lords on the subject of internal transport and coastwise shipping, Lord Leathers, Minister of War Transport, made the following observations on the reception and handling of cargoes at British ports:—

" To some extent," Lord Leathers said, " the efficiency of our distribution of imported goods depends upon the way they have been stowed in the ships' holds in the oversea ports. We have to see that the stowage is done, not only to secure the best balanced cargo for the utmost use of shipping space, but also to enable the quickest discharges to take place in this country, and a lot, therefore, depends upon the efficiency of stowage at the ports abroad, and this we watch most assiduously. We must also avoid a ship being brought to a port where delay in discharge or in inland distribution may occur, or where unnecessarily long hauls may be entailed.

" This work of allocating ships to the most suitable ports is the task of the Diversion Room in my department. They are in constant touch with ships in transit from oversea and they issue the necessary orders, where a change in the destination port is required. They know the position in every port, the availability of berths, cranes and labour. They know the reception capacity of quays, warehouses, granaries and tankage, the sorting accommodation, the relative urgency of cargoes, the railway, road or canal capacity, and the other factors that have to be taken into account before deciding upon the right port of discharge."

The docks of this country, said Lord Leathers, were the nodal point of our transport system. The most fundamental development had been the schemes for decentralising dock labour. Separate schemes were introduced a year ago on the Mersey and the Clyde. Somewhat similar schemes had been established by the National Dock Labour Corporation at a number of other ports within the last five months. The total number of ports now covered by the corporation was 22 and shortly two more ports would be added. As a result of the scheme it could definitely be said that the unauthorised stoppages of work which previously were frequent were now rare and that the artificial shortages of labour created by men refusing particular jobs had ceased. The habits and traditions of casual work at docks could not be altered in a short time. Minor difficulties were constantly cropping up which required solution. No insuperable difficulties had been experienced and it was unlikely that after the war casual labour would be resumed. " I am glad to say," he added, " that the system of transferring dock workers from one port to another is now working very smoothly and is proving helpful. In certain circumstances, not difficult to imagine, the scheme may make a vital difference to our supplies."

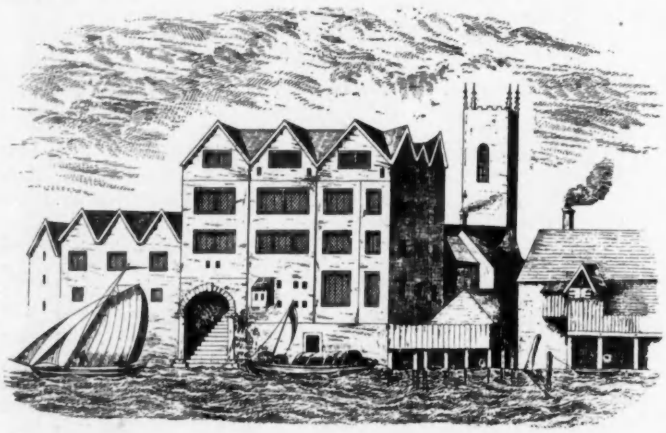
London Watermen and Lightermen

The Record of an Old-established River Order

By FRANK C. BOWEN.

Early History

The peculiar characteristics of the London River in the olden days, when in the absence of good roads it was the main highway in and out of the Metropolis and when the majority of ships handled their cargo into barges in the stream, have made the position of the lightermen and watermen a very important one from time immemorial. Although the Company of Watermen and Lightermen of the River Thames only dates from 1827 in its present form, its work was carried out by a precisely similar foundation, except for its dignity in the City of London, for over two-and-a-half centuries before that, and the watermen and lightermen have performed their duties under varying control—for, while they granted monopolies, our forefathers objected to privileges without liabilities—from an earlier date than we have any records.



Watermen's Hall, 1647.

Like all other sections of the London community, the river men banded themselves together to resist any attacks on their interests, and as most of the ferry, wharf and other rights on the Thames were in the hands of nobles or religious establishments, they had powerful backing, provided they submitted to the discipline of their masters. The lightermen must have been a numerous body as soon as the City outgrew the supplies of the immediate neighbourhood, but they, and the conditions under which they worked, did not attract the historian as much as the ferrymen who were in closer contact with the general public and who were constantly accused of extortion. The innumerable "short ferries" across the river were practically all the property of some corporation, manor or religious house for centuries, but the Long Ferry from London to Gravesend, where the traveller would join the Roman Watling Street for Dover at a point where it was reckoned to be reasonably free from footpads and bandits, was too big for private ownership although it was a monopoly like most services in the country. The date of its commencement is beyond speculation, but it was certainly of great importance after the Norman Conquest and from an early date it was, in practice, the monopoly of the watermen of Gravesend. There were innumerable complaints about their overcharging the passengers, and frequently ill-treating them or dumping them on the river bank when it was inconvenient to complete the journey, and other river men were constantly trying to get their share of a very profitable business until Richard II made the concession a royal one, which was confirmed by succeeding sovereigns. In order to reduce complaints, the actual grant made the monopoly apply to the Westward passage only, leaving the Eastward one free to all, but as it was uneconomical to maintain a one-way service, the Gravesend men secured the whole business.

Tudor Legislation

King Henry VIII objected to lawlessness on the part of anybody but himself, and in 1514 caused an act to be passed which laid down strict regulations for the conduct and fares of the Short Ferries as well as the Long. The regulations were intended to put an end to the "many assaults and affrays which have daily been made, so that often times thereof manslaughter doth ensue." The watermen certainly were a turbulent crowd and the Act would have been very useful had those who framed and passed it thought of making anybody responsible for its clauses being carried into effect. The result of this omission was that conditions were as bad as before until 1555, when a new act provided that the Lord Mayor and Court of Aldermen of London should annually elect eight of the wisest, most discreet and best sort of watermen, being householders and responsible parties, to be the "Overseers and Rulers of all the Wherrymen and Watermen of the River." They had the power of licensing men and boats for passenger work, adequate rights of punishment, and although there were still innumerable complaints, they did their work well enough to be granted arms by the Queen in 1585, arms which are inherited by the Watermen's Company of to-day.

In those days of river pageantry and passage there were still, in addition to the public watermen, a considerable number of men who wore the livery of one or other of the City companies, or of the nobles whose town houses fringed both sides of the Thames and who used it as a highway for their decorated barges. Their number was, however, declining rapidly by that time.

Queen Elizabeth's establishment of the Legal Quays in the Pool of London, the only places where cargoes could be landed or shipped, was an excellent move for the collection of customs, but it cramped the port terribly. With its trade growing so rapidly, it was necessary for more and more ships to anchor in the stream—permanent moorings were later laid to reduce confusion—and move their cargoes by barge. This offered an ideal opportunity to the pilferers and river thieves, so that measures were taken to register the lightermen as well as the dock labourers, and to take precautions that only the most reputable men should be employed. At this time, and for long afterwards, they were quite separate from the watermen.

The rulers must have had some premises in which to conduct their business from their first appointment, but there is no record as to whether it was in a private house or a tavern. The first Watermen's Hall was apparently built about 1645, the exact date being lost in the destruction of practically all records during the Great Fire of London. It was on the riverside at Coldharbour, its land entrance being in Upper Thames Street. It was rebuilt on the same site after the fire, the move to the present hall in St. Mary-at-Hill being made in 1780.

Watermen and the Navy

One of the many duties undertaken by the rulers was the provision of men for the Fleet. Thames watermen, being skilled seamen, were liable for naval service from pre-Norman days and when the impress, against which there was little or no complaint, was replaced by the Press Gang they became a popular target, although being under the protection of the Corporation of London the Lord Mayor severely checked any tendency to go over the strict legal line. The full control of the Watermen's Company, as it soon came to be called, permitted the Admiralty to intimate its requirements to the rulers and the quota was chosen and drafted into the Fleet, where they were very highly valued, with the minimum of hardship. The Gang still made raids when they were particularly short of men, but only in an emergency.

Samuel Pepys, "taking oars," on one of his many river trips, was grossly overcharged and abused by the watermen whom he employed. Not being a fighting man by nature, he paid what was asked, but hurried back to the Navy Office and in a very short time the offenders were pressed into the Fleet.

Joint Incorporation

In the meantime the lightermen, whose rights were confined to the length of the City river front for many years, were constantly clashing with the watermen in their efforts to extend their liberties. The matter was brought before Charles II in 1667, and with his usual flair for shifting all troublesome matters to other shoulders, he ordered the Lord Mayor to investigate the matter and to reach

London Watermen and Lightermen—continued

a fair compromise. It took several years to arrange any sort of scheme at all, and it was not until 1700 that the Act was finally passed which incorporated the watermen and lightermen into one body, three additional rulers being elected from among the lightermen and the limits of their privileges being extended to coincide with those of the watermen, viz.: the whole river from Gravesend to Windsor. Only the bargemen from Ware were allowed to break this monopoly, as a reward for their gallantry in keeping the City victualled during the Great Plague.

The attitude of the rulers is shown by the wording of the 18th Century licence, which was granted to the recipient " for the better relief of himself, his wife and family, as also for keeping him from idleness, lewd company and folly," while a postscript was added in individual cases that the holder was not to sell fruit or strong waters, or row in any bumboat, or have any dealings with shipkeepers in any way whatsoever.

Despite such precautions, and the special marking of embarking places beyond which no waterman might tout for hire, there were still repeated complaints that passers-by were molested and insulted if they did not want to take a boat, and that passengers had their clothes torn and suffered injuries in fights between the watermen as to who should carry them. They were as ready to fight as they were in the days before there was any control; this reputation was put to some purpose in 1748 when the French Players, fearing a popular riot on account of their nationality, hired a number of watermen armed with cudgels and stationed them in various parts of Drury Lane Theatre.

For their better control, every waterman had to wear a uniform coat and a large badge on his arm which would show up plainly by the light of a lantern. Doggett's Coat and Badge still shows the Eighteenth Century pattern.

After the amalgamation, all lighters and lightermen on the river were registered like wherries and watermen, but this control did not prove any check to pilferage from ships in the stream, which steadily increased all through the Eighteenth Century and attained appalling proportions before it was checked by the establishment of the Thames Police and the construction of dock systems for the handling of cargo under guard. In successive efforts to check the evil, the responsibilities and powers of the Company had been steadily increased.

Attainment of City Company Status

The construction of the docks greatly added to the lighterage business of the river, not only to deal with an increasing number of cargoes but, in the first place, to remove the spoil from the excavations to the sites further upstream where it was used for reclamation work. This led to increased numbers and a revival of the suggestion, first put forward in 1770, that the Watermen's Company should be admitted a City Company. It is significant that, while this move on the part of the rulers was strongly supported by the shipowners, merchants and other business men of the City, the rank and file did not desire any more disciplinary powers to be granted and the sponsor of the scheme was burned in effigy at the Tower Dock. Actually, the suggestion proved to be very difficult to carry into effect, on account of the ruling body having been established by Parliament and not by Royal Charter like the other City companies, but it was finally contrived in 1827.

With its new status, the Company was given new powers by the Act of Incorporation. All watermen and lightermen navigating the Thames did so by virtue of their holding the freedom of the Company, and had to be individually licensed in addition. A seven-year apprenticeship was laid down and measures were taken to eliminate many of the old abuses, although they were not entirely successful.

The first real trouble of the new Company was the introduction of steamboats on the river, which was naturally a very serious matter for the wherrymen. They fought many cases and got captains punished by fines, but they were unable to hold up progress and eventually freemen of the Company were shipped in the steamboats in order to comply with the law, just as they are today. Finally, the watermen established a steamboat company of their own on co-operative principles.

Advent of the Port Authority

The middle of the nineteenth century, with its rapidly-changing conditions and the growth of London trade, saw the Company's powers gradually curtailed. The Watermen's and Lightermen's Amendment Act of 1859 gave the control of the river above Teddington Lock to the newly-constituted Thames Conservancy. When the Port of London Authority was established by Parliament in 1908, the greatest blow of all was struck; the Act transferred the duty of licensing craft and men to the new body.

Wapping Old Stairs
(from an engraving by T. Rowlandson)

A gigantic petition had been presented to the King against the proposed law and over 4,000 signatures were obtained in a big marquee erected on Tower Hill, but even the men's leaders realised that the historic privileges had served their purpose and that new conditions were demanded. So the last of the actual duties of the Company, except the administration of the many charities which they had established, were ended and the first licences issued by the Port of London Authority omitted all mention of the Company as was, of course, strictly correct. But the watermen refused to acknowledge the validity of licences which were not headed by the time-honoured coat of arms and the P.L.A., who saw no good purpose in stirring up bad feeling, had a rubber stamp made to satisfy the river men.

Shortly afterwards they again exhibited their broad-minded attitude and came to an arrangement with the Rulers of the Company to carry out the present routine and act on behalf of the P.L.A. in the arrangement of apprenticeship, the examination of applicants for watermen's and lightermen's licences and their periodical renewal. Between Gravesend and Teddington Lock, river work in barges, tugs and passenger vessels is still the monopoly of the freemen of the river who are quite content with the control of the P.L.A. through the Watermen's and Lightermen's Company.

Notes of the Month

Proposed New Dry Dock at Wilmington.

The United States Government are reported to be considering the construction, at a cost of 2 million dollars, of a new dry dock for the Navy at Wilmington, North Carolina, with an alternative site at Southport. The size of the dock has not been stated.

Improvements at Annapolis.

Various improvement works are in hand at the Port of Annapolis, Maryland, U.S.A., including timber pile ferry slips, approach bridges, reinforced concrete bulkhead and a stone breakwater, 800-ft. long. The estimated cost is about one million dollars.

Enlargement of Louisiana Channels.

Tenders have been invited for the work of enlarging three navigable channels in the district of Lafayette, Louisiana, U.S.A., viz., the Bayou Queue de Tortue, Indian Bayou and Bayou Carenero. The total length of channel is between 18 and 19 miles and the estimated volume of spoil to be removed about three-quarters-of-a-million cu. yds.

Development of Northern China Ports.

Taku Harbour, in North China, is in process of expansion, under the direction of the North China New Ports Temporary Construction Office, an independent bureau of the South Manchurian Railway. Improvements at Tsingtao Harbour are being made by the Tsingtao Wharf Company. Funds in both cases are being supplied by the North China Development Company.

Australian Ports Cargo Committee.

With a view to speeding up the turn-round of ships in Australian ports, Cargo Committees have been set up in the harbours of the various States. These committees have wide powers entrusted to them to prevent quayside congestion by expediting loading and discharging operations. The step has been taken under the National security regulations.

Tees Conservancy Commission.

During the absence on leave, following a severe illness, of Mr. F. T. Nattrass, clerk and general manager of the River Tees Conservancy Commission, Mr. P. A. R. Leith, the chief engineer, has undertaken the duties of acting general manager. The accountant, Mr. Horace James, is discharging the duties of clerk.

The death has been announced of Alderman W. F. Whitwell, a member of the Commission, who was also chairman of the West Riding County Council.

Canteens at the Port of Liverpool.

Speaking at a meeting of the Mersey Docks and Harbour Board on March 23rd, Mr. R. L. Holt, chairman of the Docks and Quays Committee, said that the programme for the construction and equipment of canteens at the port was approaching completion. Returns from the caterers to the Ministry of Food showed that the following meals were served on a particular day at the canteens: Hot luncheons, 18,000; cold luncheons, 10,000; snack meals, 53,000; beverages, tea, minerals, etc., 84,000.

New Florida Barge Canal.

A proposal is under consideration by the Rivers and Harbours Committee of the United States House of Representatives for the construction of a barge canal, 9-ft. in depth, across the State of Florida, with the object of providing a continuous inlaid water route from the Gulf Coast to oil fields in the East. The canal would have a length of 200 miles and would form a link in the Intracoastal Waterway extending from the Port of Corpus Christi in Texas, to Apalachicola, in Florida.

Southampton Harbour Board.

Mr. Harry Parsons has been re-elected chairman of the Southampton Harbour Board.

New Quay Sheds at New York.

The Department of Docks, New York City, U.S.A., has in hand an extension of the riverside shed accommodation at North and East Rivers.

Blyth Port Health Authority.

The Blyth Port Health Authority has elected Alderman F. Rafferty as chairman and Alderman H. Donnachie as vice-chairman for the current year.

Humber Conservancy Board.

At the annual meeting, on the 28th April, of the Humber Conservancy Board, Mr. J. Bentley Bennett, of Goole, was re-appointed chairman and Mr. W. Minnitt Good, of Hull, vice-chairman.

Tyne Commission Appointment.

The position of electrical engineer to the Tyne Improvement Commission, in succession to Mr. William Copeland, who retired after 38 years' service, has been filled by the appointment of Mr. W. R. Shepherd, of Brigg, Lancs. Mr. Shepherd has had experience in works at Scunthorpe, Manchester and on the Tees.

Death of Former Dry Dock Official.

The death has recently occurred of Mr. John Wait, formerly secretary of the Mercantile Dry Dock Company, Ltd., Jarrow, an appointment which he held from 1911 to 1924, when he become agent of the Company's East End Estate. Mr. Wait had attained the age of 82.

Dock Labour Scheme for Scottish Ports.

A dock labour scheme for the East Coast of Scotland has been brought into operation at the Ports of Grangemouth and Bo'ness. An Area Board has been appointed, with Mr. E. W. Burness as chairman; Messrs. R. Bruce Peddie and James Anderson as manager and sub-manager respectively and Mr. Robert Robertson as accountant-agent.

Dock Labour Scheme for Middlesbrough and the Hartlepools.

A dock labour scheme for the Ports of Middlesbrough and the Hartlepools constituted under the Essential Work (Dock Labour) Order, 1941, came into operation on May 4th. It follows the same lines as schemes at other ports, except that it makes provision for double shift working at Middlesbrough Dock and the River Tees Wharves.

Notable Blasting Operation at Swedish Port.

In order to deepen the approach channel to the Port of Uddevalla, on the West Coast of Sweden, a huge blasting operation was undertaken, stated to be the greatest submarine blast in Europe for non-war purposes. The charge was 9,450 kilogrammes of dynamite placed in 1,365 drilled holes with an aggregate length of about 7,000 metres. It is estimated that 7,500 cubic metres of rock were dislocated under water.

Intensified Canal Traffic in Germany.

With the object of relieving the railways of some of their traffic burden, German transport agencies have been instructed to make full use, wherever possible, of rivers and canals. It is pointed out that there is scope for a larger volume of goods despatched from Hamburg to Berlin on the Elbe and Havel Rivers. Similarly water-borne traffic between the Rhineland and Central Germany is to be increased and greater use made of the Mittelland Canal and the River Oder.

Capstans for Docks and Harbours

The Application of Haulage Appliances to Quayside Work

By J. DALZIEL, M.I.E.E.*

(Concluded from page 14)

Capstans of Rated Pulls Exceeding 1-Ton Ropes

The hemp ropes generally used with capstans and of a size convenient to handle, are suitable for hauls up to 30 cwts. or in extreme cases 2 tons. There have been cases on fixed bollard loose rope type capstans where wire ropes have been used, but these groove the bollard and speedily destroy it. To obviate this "welps" have been bolted to the bollard, so that they can be renewed as required; the bollard is thus protected but even so, the arrangement is unsatisfactory. Grooves form very rapidly and their formation for one thing prevents the rope from slipping vertically as the coils are spiralled on to the bollard and may cause successive coils to lock on each other. Furthermore, the ropes are uncomfortable to work and loose broken strands are dangerous and liable to injure men's hands.

Free-Bollard Capstans with Wire Ropes

Where, therefore, the required capacity of a capstan is in excess of 30 cwts. or even of 1-ton normally, while the load dictates the use of wire in preference to hemp ropes, the former should be applied as a fixed wire rope on a free bollard type capstan. Such capstans present the same problem with regard to motor characteristics as those already described and to an even greater extent owing to there being no slip of the rope itself and to the rope being comparatively inelastic.

The free bollard capstan having fixed wire ropes is so called because the bollard can be released from the driving mechanism by a clutch so as to allow the rope after being wound up on the bollard, to be pulled out by hand. This is a preferable arrangement to the bollard being power rotated in reverse to wind the rope off, as it is desirable to keep the rope taut as it comes off the bollard in case loose coils may be wound back on to the bollard in the reverse direction or may otherwise foul each other. If the rope is to be pulled off the bollard, there is obviously always some amount of tension on it tending to keep it taut.

The clutch is sometimes of the claw type and sometimes of the friction type. Where it is of the friction type the tension between the friction members may be adjustable so that some slip with consequent easing of the rope pull and reduction of snatch in starting up may be provided for. According to the writer's experience adjustable friction clutches are not altogether reliable and require more attention to keep them in adjustment than they are likely to receive. In particular, they are practically always set so that the slipping point is much higher than is sufficient to give adequate pulling power during actual haulage and too high to give protection to the ropes in starting. A friction clutch may, and in the case of some free barrel capstans of high repute does, take the form of a centrifugally operated clutch. On the whole, the writer prefers that the clutch be under the full control of the operator.

The protection of a friction clutch is advantageous and necessary, as a safeguard against the "peak" snatch which may be set up by the inertia of the rotating parts; the main protection against snatch arising otherwise must, as with the loose rope capstan, be provided electrically.

The brake is, of course, an essential feature on the free-bollard as on any other form of capstan, and should stop the bollard within the required number of revolutions on switching off. In the case of both D.C. and A.C. wire rope capstans, the brake in conjunction with the switch gear and clutch has a further part to play in facilitating starting up and the application of pull to the load without snatch; furthermore it must hold the bollard against the back pull of the spring of the rope when the latter is tautened up on to the load but power is not, for the moment, being actually applied

Its operation is arranged with relation to the application of the clutch which must come first and as will be shown, must be independent of the release of the brake which must come subsequently.

As in the loose rope type of capstan, D.C. free-bollard capstans, by reason of their falling-with-load speed characteristic, are easier to design and operate than 3-phase capstans. With the resistance starting used with them they can in general be started up and pull applied after the clutch has been engaged without undue snatch, provided supplementary resistance is employed to make the start gradual enough. It is important that the resistance be of sufficiently high ohmic value to keep the speed down on even the lightest loads and particularly when hauling in slack rope, so that the speed eases down to stalling point without the development of any high torque as the rope tightens. If too much resistance is cut out before the rope tightens on to the load and the motor speed is allowed to get too high, snatch will result from the mechanical inertia of the moving parts apart from any effect of the electrically developed pull and it is in these circumstances that some protection is afforded by the slip of the friction clutch. To a great extent, therefore, even with a more favourable characteristic, the D.C. motor has features in common with the three-phase machine with which, however, the effects are more pronounced and are therefore dealt with at greater length below.

The sequence of operations of a D.C. free-bollard capstan in starting up should accordingly be as under, the motor being wound either straight series or compound with a light shunt winding.

The clutch may be of either claw or friction type and may be operated either by hand lever or by solenoid.

Friction operation of the clutch, as just mentioned, has advantages with D.C. drive, but in view of the automatic fall of speed such operation is less essential than in the case of three-phase capstans. In starting up, in the first place, the clutch should be engaged; next the brake should be released and thereafter driving current should be applied to the motor through a heavy resistance, as above, of such ohmic value as to keep the maximum speed down even on the very light load of hauling in the slack of the rope and likewise such that immediately the rope commences to tauten up on the load, the speed drops and finally the motor stalls, the current thus being insufficient to produce the torque requisite for hauling a heavy load.

When, but not until, the rope is fully tautened up on to the load, the remaining resistance should be cut out, the raft of wagons being started and accelerated accordingly. There should be no necessity for switching off in the meantime, but if current is switched off for any reason the rope should be kept taut on the load by the clutch being left engaged and the brake applied, the switch gear being arranged to provide for this. The prime necessity is to start the actual haulage of the load on a taut rope. In stopping, current should first be switched off and the brake applied, the clutch continuing in engagement until the wagons are taken charge of externally by application of their brakes or otherwise.

There is no necessity under these conditions for any snatch on the rope taking place, but obviously such a course is possible with too early cutting out of the starting resistance, that is by bad manipulation on the part of the capstan operator and the slip of a friction type of clutch provides some safeguard against this.

As already suggested in respect of loose rope capstans, it is advantageous to mount the starting resistances and other accessory

*Late Assistant Electrical Engineer, London, Midland & Scottish Rly.

Capstans for Docks and Harbours—continued

control gear above ground; they may, of course, be operated by remote control gear from the capstan position by either pedal or hand operation. This is essential, of course, with loose rope capstans or with free bollard where the clutch is hand operated; on the other hand it is equally possible to control free bollard capstans from some point remote from the capstan either by pilot or master controller or by push-button.

These notes apply equally to three-phase as to D.C. capstans, but in the former case with the free bollard, as with the loose rope, type of machine the most suitable three-phase motor is the high resistance rotor type started up by being thrown straight across the mains so that there is little or no starting resistance and gear to be accommodated.

The use of the high resistance rotor motor with its drooping characteristic and pre-determinable stalling torque prevents undue pull and snatch on the ropes resulting from excessive torque arising from electrical causes, but it obviously cannot have any effect on the development of snatch arising from the inertia of the rotating parts in the event of a hitherto slack rope being allowed to tauten up suddenly on to a heavy load.

In the case of three-phase, as in D.C., capstans, the clutch is sometimes of solid engagement claw type and sometimes of friction type, but with the former the slip of the friction clutch provides some safeguard both against inertia and against the tendency of the motor to maintain its speed.

The advantages of the three-phase machine lie as already explained in the absence of main starting resistance and the limitation of motor torque. It is clear, however, that even having regard to this latter, as the motor speed is a function of periodicity and not of effective voltage as in the D.C. case, when it is switched on to gather in the slack of the wire rope, it will have accelerated to full speed before the rope is tautened up on the load. In this case the torque limitation comes into play too late to be of service, as while the rotor and other rotating parts will slow down they will in doing so inflict a severe snatch on the rope in their endeavour to start the load up to the speed corresponding to that at which they were previously moving, in other words, due to their inertia. Under these circumstances the rope and even the wagon to which it is attached, may be damaged.

The slip of the clutch may mitigate such a snatch but will not entirely prevent it.

In some three-phase capstans with which the writer dealt, provision for eliminating snatch arising as just mentioned, was made in the arrangements for the application of pull to the load after the rope was finally tautened up.

During the starting of the motor and the hauling in of slack, torque was still further electrically limited by the introduction into the stator circuit of the motor of resistance or reactance reducing the applied voltage and consequently bringing the motor torque down to a still lower figure, as explained earlier, of value just sufficient with an adequate margin, to pull in the slack but to cause the motor to stall immediately the rope tautened up sufficiently to produce any appreciable load. The sequence of operations in the case of these capstans was, therefore, pretty well as described above in connection with the D.C. capstans, namely, the clutch was first applied and then simultaneously with the release of the brake, current was switched on to the motor through a high resistance or reactance which was cut out by a further motion of the controller when the rope was taut on the load, snatch at this point being obviated by the limited motor torque.

Owing to the weight of the rope being taken up gradually and to what measure of elasticity it embodies, in general the load on the motor does not rise suddenly and its consequent fall in speed takes place over an appreciable period so that no mechanical inertia effects arise.

Where, however, the conditions are such that the load does rise suddenly, dependence must be placed upon the operator to switch off with automatic operation of the brake just prior to the rope tautening up, leaving the clutch engaged. In this event mechanical snatch on the ropes should not only be minimised but should be obviated altogether by the kinetic energy or inertia of the rotating parts being absorbed by the brake.

Furthermore with the clutch remaining engaged, the brake will continue to hold the rope taut on the load, so that no repetition of the process of tautening up is necessary. This is one of the important functions of the brake afore-mentioned. As already described the motor can, after hauling in slack, be switched over on to full mains pressure as soon as the rope is tight. On a taut rope under the conditions described and with efficient operation it may be re-started by passing through the resistance position directly over to the full pressure position but without allowing any slackening of the rope, the brake being disengaged simultaneously with the switching on of current, and under these circumstances the load on the rope should be subjected to no greater pull than that given by the maximum torque to which the motor is limited by the resistance embodied in the rotor which may be as low as double full load.

Obviously the manipulation of the control gear of these capstans in the three-phase, as in the D.C., case requires more of the operator than the mere depression of a pedal, as is the case with a loose rope type of capstan, but the additional movements and their appropriate use and timing should be well within the capabilities of any reasonably intelligent man; if anything, the advantage of simplicity lies with the three-phase machine.

The higher resistance rotor motor is, of course, low in efficiency, in the case of the free bollard as in that of the loose rope capstan, but as a capstan motor it is as effective in the former as it is in the latter case.

An illustration of a hand lever operated "Free-barrel" capstan appeared on page 13 of the first instalment of this article.

Special Capstans

As is evident from what has been said, the standard capstan for general work and that by far the most widely in use, is the 1-ton loose rope type. This generally gives its rated pull at 150-ft. per minute, but this speed may be varied up to 300-ft. per minute or thereby, more particularly on electric capstans for traverser and turntable work where single, or only a small number of wagons have in the main to be dealt with, and have in the case of traversers to be operated with more or less of a sharp snatch up short, steep gradients leading to tables set on a higher level than that of the normal rail tracks.

There are some instances of special forms of capstan which are of interest. For example, for dealing by the same capstan with hauls of different character along the same tracks, viz., long haulage of a raft of wagons and "fly-shunt" work with one wagon only, the capstans, which were used in connection with feeding coaling cranes, were fitted with two diameter bollards with a rope speed on the larger diameter of the bollard of 700-ft. per minute, the speed on the smaller diameter being about 450-ft. per minute.

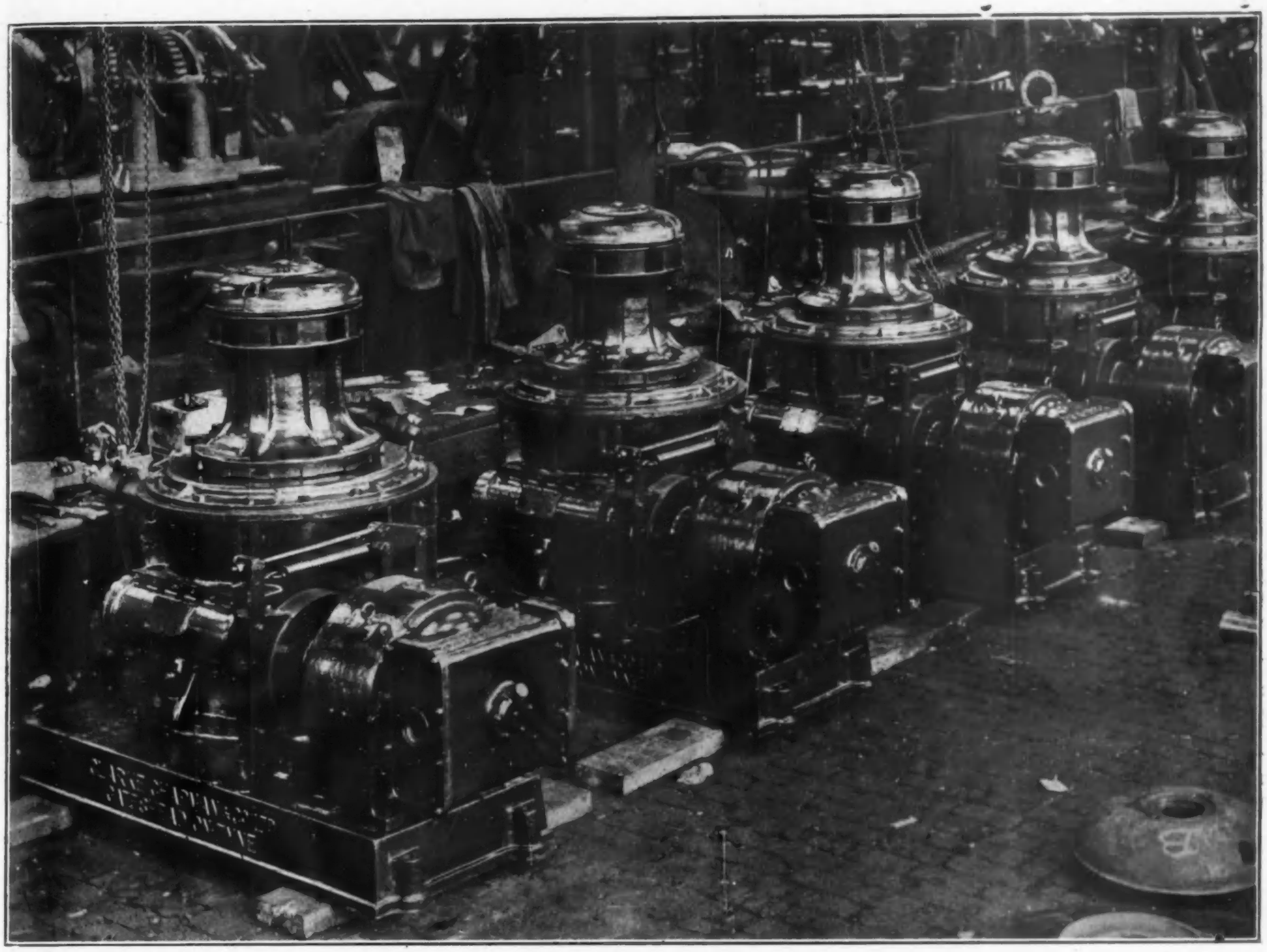
With some such capstans with which the writer was concerned, put down at a Northern harbour it was not considered necessary to adhere to the long-established standard pull of 1-ton at normal full load with a 1-hour rated motor, the rated pull being 15 cwts. with a pull-out and stand-still torque giving 2-tons maximum on the normal or small diameter of the bollard the motor rating being 1 hour at rated pull.

On these capstans the low speed was used for hauling the main raft of loaded wagons up to the points in the vicinity of the coaling crane cradle, though necessarily not very close to it; the high speed shunts the wagons singly on to the cradle, and thereafter hauls them back empty through the points to the empty track which runs back in the same direction as, and more or less parallel to, the full wagon line.

At the same port some free bollard fixed wire rope capstans, which were of normal speed were specified to have the same pulls and motor ratings; both these capstans were very successful machines.

As already cited, hemp ropes for a pull above 1 ton or at most 30 cwts. are cumbersome to handle, and capstans of 30 cwts. and 2 tons, the installation of which of late years has been fairly common, are generally of the free bollard type with wire ropes. Until a few years ago the heaviest pull of the railway capstan was 3 tons and this was very exceptional. The same figure applied to dock and harbour capstans for dealing with trucks along railway tracks.

Capstans for Docks and Harbours—continued



Consignment of 5-ton Capstans for use at a Dock in Brazil.

Heavier capstans, up to about 10 tons pull, or more, have been installed on quays for ship haulage, berthing, etc., these have been very few in number in the case of commercial docks. They present similar problems to those above described in connection with truck handling capstans, but in perhaps a somewhat exaggerated form; they must be capable of being stalled without detriment and of continuing to haul while in this condition and, while the hauling speed under load is very slow, they must be capable of a high speed for paying out, or gathering in, loose rope.

The illustration appearing on this page shows a number of 5-ton quayside capstans made for a dock in Brazil for which a number of 10 and 15-ton capstans of similar design were also made.

The medium of haulage is necessarily a heavy wire rope, winding up on to the bollard which is, of course, correspondingly larger in diameter and therefore, inversely slower in speed of rotation than in the case of smaller capstans and it is even more important than with truck hauling capstans that the rope be not over-strained, either by straight overload or by snatch, the breakage of such a rope running along a quay-face being a very dangerous matter.

Typical haulage speeds are 40-ft. per minute on rated full load and 120-ft. per minute for dealing with slack rope. Where such capstans were hydraulically operated, they were generally driven by four cylinders and rams arranged in pairs and driving the bollard through one or more sets of spur or bevel reducing gear, the whole being built into a box on the same lines as above described, but of course very much larger and heavier throughout.

Control was in general by double-ported or other suitable valve, operated in general from a hand wheel.

The hydraulic operation of these capstans was not entirely satisfactory and in some circumstances where compressed air was available it was used for capstan operation. Such compressed air capstans were, it is understood, highly successful and gave more flexibility of control and speed than either hydraulic or electric. Where they have been superseded, it has been because of the displacement of compressed air, as a means of power transmission, by electricity.

There are very few electrically-operated capstans of this type and purpose, it being the modern practice in commercial docks to berth by means of the capstans carried on the ships themselves. Originally where such capstans were installed, they were mainly D.C. driven through worm gear and a train of one or more sets of spur or bevel gear, the motor being series wound or compound with a very light shunt winding, control being effected by resistance in the armature circuit adjusted by a tramway type controller or by a master controller with contactors.

This form of capstan was not very successful and gave rise to considerable rope troubles and it obviously was not well fitted to permit of stalling without excessive overload, or to obviate overloads and snatch on the haulage rope. A circuit breaker was always fitted but did not prevent the drawbacks referred to; a circuit breaker is, of course, one of those devices which acts as a corrective after the event and not as a preventative.

Three-phase drive is of no advantage in this type of capstan, but the reverse in its absence of speeding up on light load. If

Capstans for Docks and Harbours—continued

used the motor would be of slip ring type controlled by resistances in the rotor circuit. A three-phase variable speed commutator type motor on the other hand, would be a very suitable machine for application in this connection, having a characteristic and speed control almost ideal for the purpose, except that as far as the writer is aware speed is not controllable down to stalling point. The writer is not aware of any such application having been made, so far.

Various schemes which are equally applicable to ships' capstans have been embodied in later capstans to improve matters; the most usual and successful is the adoption of fluid couplings on the principle of the fluid flywheel used on some motor cars and forming a specially reliable type of friction clutch. This has the effect of definitely limiting the overload which can be transmitted from the motor and of permitting stalling without detriment, while maintaining pull; for this reason and also since most of the rotating parts on the rope side of the fluid clutch are of low speed and inertia it also in great measure mitigates the snatch arising at a slack rope tautens up.

A further method of operation is for the capstan to be driven by a variable speed hydraulic motor, working in conjunction with an electrically operated pump supplying the pressure fluid, generally oil. The variable speed motor is very generally of the Hele-Shaw type, but there are, of course, other types. This method has been used more particularly on ships and for anchor windlasses and the like, rather than for quayside capstans and, as a matter of fact, most of the electric methods of operation described are applicable to, and have been used for, ships, at least as much as for quayside capstans.

Conversely, any method, including that about to be described used for ships capstans, is applicable to quayside capstans, though not hitherto applied thereto. Ships' capstans in fact, while making the same demands for stalling, prevention of snatch and overload and speed variation, as quayside capstans, make these demands in even greater measure. The actual speeds and powers required vary, of course, widely in correspondence with the size of the ship concerned.

Typical figures relating to such capstans on a large cross-channel vessel are as follows:—

To stall at a pull of 6 tons and to continue to exert this pull as long as may be necessary and, by brake action, without power, if cut off by the circuit breakers, and also to exert a pull of 5 tons at about 55-ft. per minute with a speed of 250-ft. per minute when hauling in slack rope.

Operation is to be arranged so that when, with all resistance cut out of the motor circuit, current exceeds that for the maximum pull of 6 tons, a stalling relay trips and opens the circuit of one or more of the contactors, inserting such resistance as to leave sufficient current passing for the bollard to continue to exert the specified pull and to permit it to take up slack as the vessel gives to the pull.

The light load speed is attained by weakening the motor field, by means actuated by a load discriminating relay operating when the controller is on the last two notches, on the last but one of which part of the field weakening resistance is short circuited so as to give an intermediate light load speed short of the maximum of 250-ft.

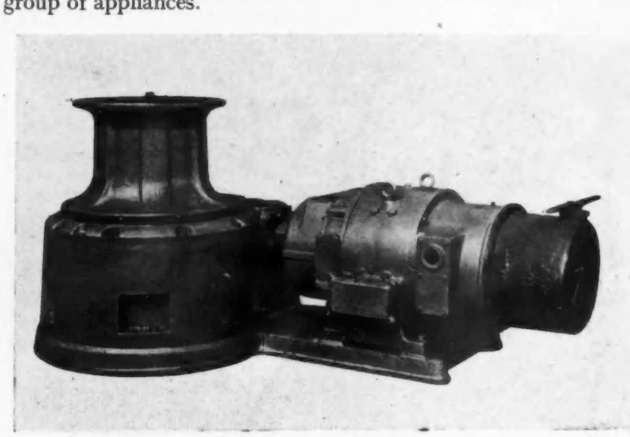
The motor is compound wound, with a light shunt winding which is weakened or cut out altogether in meeting the rising speed requirements, the series winding may also be shunted or partially cut out for very high speeds. The heaviest pulls are obtained with both windings at full strength and in some instances to give very heavy pulls at very low speeds, a potentiometer or similar circuit, is formed to strengthen the field further and to apply, though inefficiently, i.e., with a waste of current in resistance, a lower voltage to the motor armature.

The power of such capstans being considerable the only satisfactory method of control is by means of contactors, one for each speed notch, operated by a master controller of tramway type, contactors being also provided for reversing, to provide for which the circuits must be suitably arranged.

It is essential to suitably grade the resistance so that the motor may be started and accelerated without excessive peak such as to cause snatch on the rope, and the resistances, and the circuits generally, must allow for full stalling pull to continue to be exerted continuously, if necessary, without over-heating or other damage, the motor being likewise capable of carrying the current in question for an appreciable period without detriment.

Ships' capstans can also be driven on the Austin or other alternative constant current system, under which all the ships appliances work in series on a special circuit supplied by a special type of generator. With this method the motors can be controlled to give speed and torque variation from stalling point upwards to the maximum speed required, the method of control being very simple.

The principal drawback of the Austin and similar systems is that of a special circuit and generator being required, not available for other purposes of the ship's electrical equipment, and to overcome this objection, an alternative scheme has been designed in which the same form of motor is used, but is supplied from a motor generator of simplified form, installed individually for each appliance, or where possible as in some cases, fitted to a small group of appliances.



4½-Ton Electric Capstans as supplied to Cross-Channel Vessels. Motor 44 h.p. at 1,500 r.p.m. Current supply 110-volts. Enclosed magnetic brake and slipping clutch.

On similar lines capstans are sometimes operated on the Ward-Leonard system with a motor generator for each appliance, the motor in such cases being, however, of the ordinary type, having a constant field strength with the armature supplied from the generator with varying voltage from zero upwards.

These motor generator systems are costly in view of the additional electrical apparatus they embody, but they are very reliable, are simple in their operation and probably cheaper in maintenance than in the case of systems embodying heavy and extensive switch gear.

Watertight construction is even more essential in the case of ships and quayside capstans than in that of capstans for working sidings; the boxes must be self-draining and the electric insulation must be of a type highly resistant to damp, with long insulating surfaces of simple and smooth construction, not liable to collect and retain moisture in grooves or otherwise.

The powers to be dealt with, being heavy, are such as to make contactor type control relay operated essential and all switch gear should be mounted between decks as near as possible to the capstan itself but under protection from flooding and damp, while remaining easily accessible for repairs and adjustment in situ while under operation.

A view of a typical ship's capstan appears on this page.

Double Rope Capstans

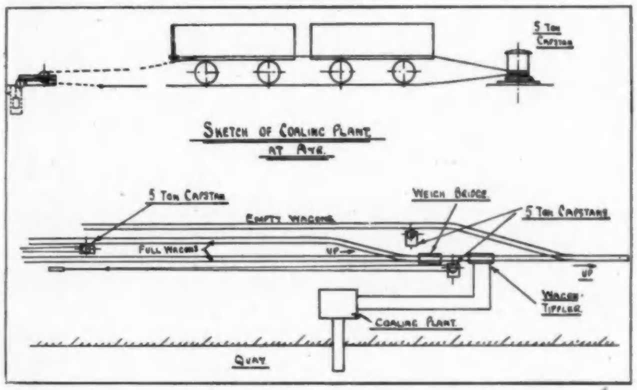
As regards other special capstans, in recent years on the L.M. & S. Rly., capstans of 5 tons pull were evolved and installed for hauling rafts of 10 to 12 coal wagons of 20 tons capacity each, or the equivalent, up inclines of about 1 in 90. The object in using these was to enable all shunting subsequent to the wagons being emptied, to be effected by gravity. The wagons fed coaling plants and were tipped and emptied on a side tipper placed at the

Capstans for Docks and Harbours—*continued*

top of the grade. The capstans took a long length of rope, coiled on correspondingly large bollards, spirally grooved to take all the rope, only one layer of which was wound on to the bollard. The hauling speed was very slow, as in feeding the plant the movement is only one wagon length per cycle at the rate of about one wagon per minute. This, where the wagons are of 20 tons capacity each, would obviously be 1,200 tons per hour, which is 100% in excess of the maximum loading capacity aimed at, namely 600 tons per hour, on the basis of the wagons averaging 12 * ns each and allowance being made for delays.

The hauling rope is attached to the wagon at the tail end of the raft, attachment being made to the coupling and not as usual in lighter cases to the axle box brackets.

Operation is by reversing slip ring three-phase motors with resistance starting and control and with traction type controllers. In preference to these a traction type master controller, with contactor grouping and resistance cut-out, would probably be found easier and cheaper to maintain, the duty on these controllers with their exceedingly frequent and heavy starts, largely against full load, being very onerous.



Where, as is most suitable and general, each capstan deals with two roads only, man-handling the heavy rope out after making a haul, is avoided by the use of what worked out to be an adaptation of the well-known main-and-tail haulage.

In these cases there were fitted two main haulage ropes, one anchored at the top and the other at the bottom of the bollard, so that one winds on as the other winds off the bollard, the turns of the former following up those of the latter round the bollard in its spiral grooves at an interval of about one groove. There is a hauling hook at each other end. At the commencement of a haul with the outgoing rope at, say, the bottom of the bollard, the bottom end rope is out its full length to attachment of its hook to the far end of the wagon raft; the top rope has completed its haul and is almost fully home on the bollard. Its hook pays out and its turns disengage from the bollard and rise up it followed by the engaging turn of the lower rope as haulage proceeds. Vice versa, the top rope is ready to be attached to the next succeeding raft when the former one is disposed of, the bollard rotation being then reversed. The two rope ends are joined by a much lighter rope passing round a spring-loaded pulley placed at the far end of the sidings from the capstan, and tensioned sufficiently to ensure the main ropes being taut enough to follow, and keep in, the spiral grooves of the bollard.

The attachment of the light rope to the main lengths is made at a sufficient distance up from their ends carrying the hauling hooks to allow of the latter being attached to the wagon coupling without the light rope being in hauling materially deflected out of the straight.

The arrangement is illustrated per diagram on this page.

This arrangement proved very successful and gave little or no trouble; it not only avoids the necessity of the heavy ropes being handled manually, but eliminates altogether the time and labour of hauling out the ropes from the bollard other than automatically.

Where the capstan had to be set out some distance from the track owing to curvature a device with vertical rollers clasping the bollard one on each side, coupled together by a species of spring loaded scissors mechanism, is fitted as an additional precaution to keep the ropes in position, but this is only required in extreme cases and had not to be used at all in the case of many of these capstans.

The remaining processes of dealing with the wagons on these coaling plants are very interesting but are not capstan operated and therefore do not fall within the scope of this article.

This was the first instance, not only of the use of 5-ton capstans for such purposes as described, but of double rope haulage being applied to railway siding operation and it was also the first instance of the successful use of spirally grooved bollards.

Following the evolution of these capstans on the L.M. and S. Railway, similar capstans were adopted by the L. and N.E. Railway, also in connection with coal loading plants.

It will be clear that the action of the double rope design is that the rope just paid out is always ready to attach to the new raft when the other rope previously hauling has fully disposed of that preceding.

The double rope principle is not, however, available in the application of these capstans to the operation of multiple (i.e. more than two) sidings by a single capstan. In these cases the capstans must be single rope type, winding the rope fully on to the bollard as haulage proceeds and requiring that it be paid out again to deal with a fresh raft. There are two major disadvantages to this, first, that hauling out and dragging the very heavy rope, as it is paid off the reversed bollard, involves hard work on the part of several men and second, that if the haulage speed of the bollard is used for paying out the rope the movement is far too slow and causes delay. To obviate the former therefore, by providing haulage power, a short pony bollard, or fleeting drum, is fitted on the top of the main bollard and from this is operated a loose hemp rope passed over a dummy bollard or fair lead at the far end of the siding and returned for attachment to the haulage hook of the main rope. This pilot rope is worked from the pony bollard exactly as is the rope of a loose rope type capstan.

The pony bollard is of the same diameter as the main bollard so that the speed of hauling out the rope and of paying it off the main bollard are the same.

To overcome the second objection, namely, the slow speed of paying out, the capstan is fitted with a special gear which can be clutched into engagement in reverse and gives a paying out speed of three times the load hauling speed. In the case of the double rope capstans, the capstan is of course used identically in both directions of rotation.

A drawing of these capstans appeared in the first instalment of this article, page 11.

The construction of these capstans is comparatively simple, apart from provision in robust construction for the heavy pulls. The type of control and its manipulation by a special operator, combined with the slow speed, and the absence of any slackening of the tension on the hauling rope until the last wagon is disposed of, makes it unnecessary to provide for any automatic limitation of torque or avoidance of snatch and the motors are, therefore, of ordinary reversing slip ring type with multi-point control. All electric gear, other than the motors and magnet coils for braking, is above ground and this includes all the gear that requires frequent attention for maintenance and adjustment.

The main-and-tail method was adopted later for a further special type of haulage which, however, is hardly applicable to dock and harbour sidings, being used where it is desired to deal with a succession of wagons unloaded at one point, the raft being brought past this point and the wagons stopped there individually as necessary. The haulage hook is attached to the last wagon of the raft in the same way as in the case of the coaling plant capstans but in the absence of gradient the capstan itself of course need only be of a very much lower haulage capacity, though the speed need not exceed that of the heavier capstans in view of the movement being wagon length by wagon length.

In general, the wagon movement is actuated by start and stop press buttons and in view of the low speed and the maintenance of tension on the rope throughout no special provision against snatch is required.

The endless rope is fitted with two hooks, as in the case of the 5-ton capstans, and a few turns are passed round the bollard with

Capstans for Docks and Harbours—*continued*

the tail end passed round a spring loaded dummy bollard also as in the case of the 5-ton machines.

Likewise, when a new raft is to be dealt with, attachment is made to it by the rope hitherto paying out, the direction of rotation of the capstan for haulage being reversed.

General Features

As regards constructional points of capstans in general, worm gear reduction is embodied in the drive of practically all electric capstans and should be of efficient type and fitted with ball or roller thrust bearings. All bearings inside the capstan box should be self-lubricating as far as possible, so that attendance to them is necessary only at long intervals. It will then be possible to adopt a construction watertight from the surface. This, however, involves heavy covering plates over the box, screwed down, so that some time and labour are required when it is necessary to lift the covers. So long as such occasions are normally rare, this is not of vital importance, but where electrical control or other gear of a type requiring frequent attention is placed in the box proper, it is desirable that the box covers should be of light plating only, of the type known as chequer plate, easy to remove and replace.

This can be only partly watertight, but it is better to accept this than to risk neglect of the gear; as already indicated, the ideal arrangement is to have such gear requiring frequent attention above ground so as to be available for inspection and adjustment without disturbance of the box which can then be made tight against surface water at least.

As already set out, however, capstans on some quay-sides may be subject to flooding from occasional wash of sea water over the quay and from backing up if the boxes are fitted with drain pipes, and in such cases a pump such as has been described as fitted to one set of capstans, actuated from one of the rotating shafts and self priming, should be fitted and should drain the capstan box automatically during rotation, the box having a sump specially formed from which this pump can draw, and down to which the water will drain.

Theoretically, the ideal design is to build up all bearings from the bottom of the capstan box, leaving the top only as a cover, but in many cases, probably the majority, the top bearing carrying the bollard shaft and taking the pull of the bollard, is carried from a stretcher cast or bolted to the top of the capstan box sideplates. In such cases the stretcher in general forms also an intermediate support for the cover plates. This construction is on the whole sufficiently satisfactory, but the bollard shaft bearing should be carried up inside the bollard as high as possible, the bollard itself being skirted round it.

For the provision of illustrations and drawings, the writer has to thank Messrs. Broadbent and Co., Babcock and Wilcox, Cowans, Sheldon and Co., and Clarke Chapman and Co.

Notable Port Personalities

XXIII—Mr. R. K. Smith

Mr. Robert Knowlton Smith, K.C., LL.B., Chairman of the National Harbours Board of Canada, was born at Amherst, Nova Scotia, in December, 1887. He was educated at the St. Francis Xavier University, Antigonish, and later, graduated in the Dalhousie Law School, Halifax, being admitted to the Bar of the Province of Nova Scotia, in March, 1911.

Mr. R. K. SMITH, K.C., LL.B.

After serving four years as a Councillor, he was elected Mayor of Amherst in 1923. He entered the Dominion House of Commons in 1925, being subsequently returned at the General Elections of 1926 and 1930.

Created King's Counsel by the Government of Nova Scotia in 1929, he was appointed Deputy Minister of Marine by the Dominion Government in 1935. In the following year, he became Director of Marine Services in the Department of Transport. In 1940, he was made Chairman of the National Harbours Board, which controls and administers the principal harbours of Canada.

Publication Received.

A copy has been received of an interesting pamphlet entitled: *Uniform of the Navy—Past and Present*, by W. T. Carman. It is copiously illustrated with coloured pictures, showing types of naval uniform at various periods down to the present day, and contains much information of historical interest. It is published by Forster Groom and Co., 23, Craven Street, London, W.C.2, price one shilling.

The London Dock Labour Scheme.

Owing to the complexity of its port organisation, the London scheme, which came into operation on March 16th last, while it follows the general line of the others, is more intricate. The port has been divided into nine sectors, which are grouped in four zones under special joint committees consisting of representatives of port transport workers and employers known as zone committees. These committees act in an advisory capacity to the local board and may be consulted by the port manager. From time to time each zone committee reports to the local board upon all matters pertaining to the local administration of the dock labour scheme in its zone.

Proposed Tunnel Under the River Tyne.

A proposal for the construction of a tunnel under the River Tyne, in the neighbourhood of Jarrow, is receiving the consideration of a joint committee of the Durham and Northumberland County Councils, who have before them a report from Messrs. Mott, Hay and Anderson, Consulting Engineers, of Westminster. According to their report, the most suitable location for the project is in the neighbourhood of the Jarrow-Howden Ferry, and the suggestion is that there should be a main tunnel having a road width of 21-ft., with a separate tunnel for cyclists, 15-ft. in diameter, which would also carry all cables and mains. The tunnels are to be arranged so as to permit a river depth of 50-ft. at low water.

Reviews

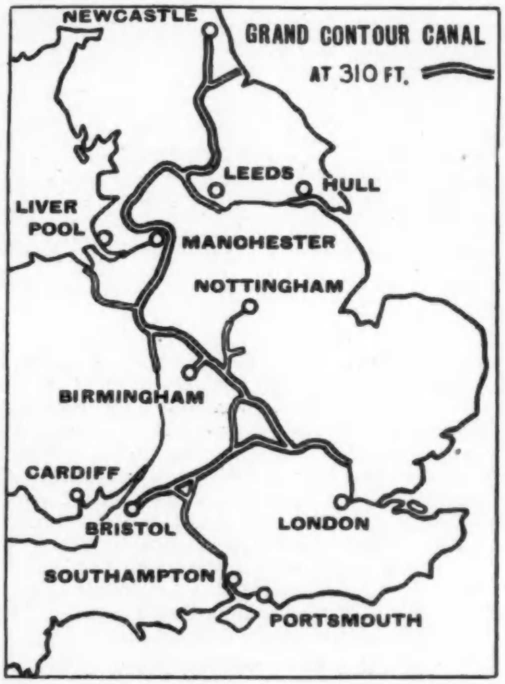
Outstanding Proposal for an Internal Single Level Water Route throughout the Length of England

The Projected Grand Contour Canal to connect with Estuaries and Canals in England, by J. F. Pownall. Pp. 35, with map. Price: 2s., Birmingham: 1942, Cotterell and Co.

Reviewed by J. M. LACEY, M.Inst.C.E.

A canal serves to bring the elements indispensable to all industrial development, viz., cheap transport, and abundant supplies of water.

If we were told that a canal could be constructed the length of England, from north to south, on a single contour, at 310-ft. above sea level, without locks, which would bring these elements to our industrial centres, we would in all probability treat the scheme as visionary.



Mr. Pownall, however, has described, in great detail, the physical and geological character of the country through which a line may be traced through the heart of England, suitable for the construction of a canal serving the great industrial centres without any variation in level. The " Projected Grand Contour Canal " is designed to have two main routes: one from London proceeding north-westwards to Manchester, and thence to Newcastle, serving Birmingham, Leeds and other centres of industry; and the other from London, westwards to Bristol, with a branch to Southampton. Connection would be made with existing navigation systems by means of locks or lifts. Mr. Pownall favours lifts as being more in agreement with the water conserving character of a one-level canal.

Mr. Pownall has recognised the necessity of large canals for efficient service, and the Grand Contour Canal will have a width of water surface of 100-ft., and a depth of 17-ft., with a clear headway under bridges of 25-ft. These dimensions may be compared with those of Continental canals, where barges of 500 tons burden and over are common. The Canal Albert, in Belgium, has a width at water surface of 100-ft. and a depth of 15-ft. The Dortmund-Ems Canal has a similar width at water surface and a depth of 11.5-ft. There is, generally, a relation between the width and the depth of a canal, and unless there are specific reasons for a depth of 17-ft., a depth of 15-ft. would appear to be more suitable for a width of 100-ft.

It must, however, here be pointed out, that the existing canals in this country were constructed under various ownerships, and, with differences in dimensions, hence the hindrance to through traffic. Moreover, in our large tidal rivers, sea-going vessels come so far inland that it has not been necessary to send canal boats to sea, while the method of working canals rendered it preferable to use boats worked with few hands at a small cost, particularly when limestone, coal, iron ore, lead and other heavy material, not easily stolen, formed the main cargo.

The Royal Commission on Canals and Inland Navigation, in their Final Report, 1909, recommended the creation of a Waterway Board to acquire and manage the principal canals in England, and improvements to the main canals linking Birmingham and the Midlands with London, and the estuaries of the Severn, the Humber, and the Mersey, to a standard necessary for 100-ton barges, or alternatively, 300-ton barges. The Grand Contour Canal Project more than fulfils these recommendations. The waterway is designed to take vessels up to 1,500 tons displacement. Coastal vessels of this burden would be able to use it, and with effective connections, the canal would form, with the estuaries and coast line, one coherent system.

In Chapters III and V, Mr. Pownall has discussed the transport facilities and the constructive aspect of the canal. The canal would permit the transport of large built-up fabrications. A novel form of service, viz., equipment hire service is to be evolved leading to the development of new industries.

The finances of the scheme, and the formation of the Canal Company as a private enterprise, are discussed in Chapters VI and VII. The canal is intended to be divided into operational stages of 6 miles each, which will be owned separately by private individuals. These stage owners would be the principals of the undertaking, and would elect among themselves the Central Board of the Canal Company. The position of these " stage owners " is discussed in greater detail in Chapter VIII.

One of the charges against the existing canals has been their original vital error of management, in the admission of private persons to the right of running boats on the canals. The private companies, who first undertook the constructions of railways, intended them to be public means of conveyance, like canals; as, however, the high speed attained required, for reasons of safety, a punctual adherence to fixed hours of arrival and departure, and implicit obedience to signals, it was found necessary that the general working of the line should be under the control of one head. Hence the general system in which railway companies are carriers, as well as possessors, of various lines.

The Grand Contour Canal would intercept the drainage of the areas lying at a higher level above its course, thus forming a catchwater canal, and would act as a conduit for distributing the rainfall on the more favoured areas to the less favoured ones, particularly to the critical areas of the Midlands. At times of copious flow, water would be freely available to be passed down to the permeable areas* lying below the canal line, and thus replenish streams, ponds, and ground water storage. Such a canal would have been a blessing in the great drought of 1934.

The canal would add to the amenities of the countryside, forming a ribbon of water, winding along at the foot of an escarpment on one side, while, on the other, the land gently falls away. A long one-level water highway available to all sizes and types of vessels.

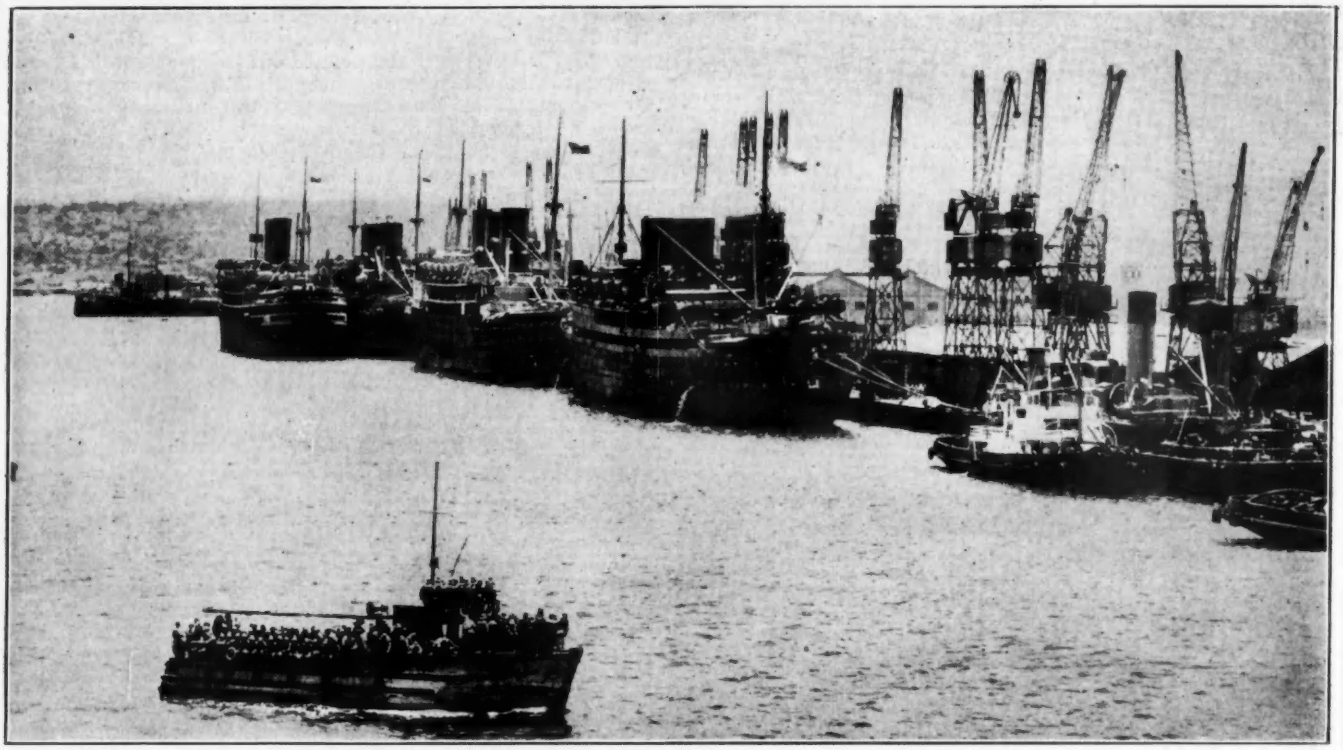
South African Ports in War-Time.

The South African Railways and Harbours Administration have just issued an interesting and attractively illustrated brochure describing their activities during the present period of world-wide hostilities and, in particular, the contribution in service which they are making towards winning the war for the United Nations.

The performances of the railway staff are highly creditable, but the immediate concern of this Journal lies more with the achieve-

*See Ground Water Supply, " Engineering," 5th July, 1935.

Reviews—continued



Great Ships packed with troops and equipment have tied up at the quays of South African harbours, which were sometimes so crowded that ships had to be "double-banked."

ments in port and harbour work set out in the section of the publication which deals with South African Harbours, which are designated "Links in Victory's Chain." The illustrations, one of which is reproduced on this page, show a great augmentation of traffic at the leading ports of Cape Town and Durban, with which the local controls have grappled very successfully. "What is a red letter day to Cape Town or Durban is a day of strenuous and anxious work to the harbour staffs. As many ships as possible have to be tied up alongside in the already over-taxed space, and double banking (two at a berth) has often to be resorted to. The harbours have had to handle as many as thirty ships, berthing and unberthing, in one day. Ships will lie off waiting their turn while others hurriedly take on stores. The biggest ships of all, like the *Queen Mary* and the *Queen Elizabeth*, lie out in Table Bay, while tankers and tenders of all kinds gather around them."

Special mention is made of the Port of Durban. "It has become the meeting place of great troop and munitions convoys, and the channel through which thousands of tons of war materials pass. In the last year, the tonnage of shipping handled has gone up by nearly 5,000,000 and the number of ships handled by more than 600, including a much larger number of big ships over 10,000 tons. The biggest ship brought alongside in the harbour was the French ship *Ile de France*, the fifth largest ship afloat, with a length of 793-ft. and a draught of more than 36-ft."

The brochure recalls the fact that Durban has a graving dock with a length of 1,150-ft. and a width of 110-ft., capable of taking the largest ships in the Royal Navy.

The harbour, it is added, is always crowded with ships repairing or awaiting repair. Convoys often reach Durban two at a time, one outward and one homeward bound, and it is made the transhipment point. There have been times when there were 64 ships in the harbour and 25 more lying outside. A convoy of more than 20 ships, perhaps half of them big ones, is not unusual. Accordingly it is not surprising to learn that the wharves and jetties are always crowded and often double-banked. The 25-ton floating crane is continuously in demand.

"All sorts of emergency arrangements have had to be made to handle this rush of traffic. The coal conveyor at the Bluff has been extended by 500-ft., new railway tracks and sheds have been hurriedly built, and wharves constructed for loading coal, iron ore and manganese ore. In the graving dock, alterations have been made to the keel blocks for supporting capital ships and additional salt water mains installed. The ordinary harbour development is also being pushed ahead as fast as possible."

All this makes a vivid and striking picture of operations similar to those carried on at many ports in this country and the brochure mentions with gratification the allusion of the Minister of Shipping in 1940 to the "efficient and expeditious manner" in which cargo is being dealt with at South African ports.

The Dock Labour Scheme

Application to all South Wales Ports

The Dock Labour Scheme under the Essential Work (Dock Labour) Order, 1941, has now been applied to all ports in South Wales, including Cardiff, Penarth, Newport (Mon.), Barry, Port Talbot and Swansea.

Mr. T. E. Merrells is chairman of the Area Board, and the members are: Mr. H. Batey, Mr. J. Donovan, Mr. J. T. Edmunds, Mr. W. J. Fletcher and Mr. W. Pinnell. The Area manager is Mr. E. L. Davies. The sub-managers are: Barry: Mr. R. J. Thomas; Cardiff, Mr. W. H. Jones; Llanelly, Mr. J. Winterbottom; Newport, Mr. G. W. Farr; Port Talbot, Mr. H. W. Horsham; Swansea, Mr. J. H. Saunders. Mr. H. G. Acreman (Cardiff), is the Port Labour Officer.

The arrangements are in accordance with the general scheme for all ports (except Liverpool and Glasgow, where special conditions prevail), with minor variations to meet local requirements.

Launching Slipways for Vessels

An Article for Students and Junior Engineers

By STANLEY C. BAILEY, Assoc.M.Inst.C.E., F.G.S.

(Concluded from page 19)

Cradles

Fig. 14 (page 40) shows a typical cross-section of the bow cradles, and Fig. 15 a side elevation. The ship is held on the ways before launching by the dog shores at the bow and stern cradles; these have to sustain the sliding pressure which amounts in some cases to several hundred tons. In ships with blunt bows, the cradles are much smaller.

Various means are employed for knocking down the dog shores, one of which is shown in the Figs. and consists of a weight of several cwts. enclosed in a vertical timber shaft, the weight is attached to a thin wire rope which passes over a pulley at the top of the shaft and goes from thence to the launching platform where it is cut by a guillotine.

To provide against the contingency of the vessel not starting easily, hydraulic rams are installed at the head of the sliding ways, against which they exert a pressure of from 300 to 400 tons, so that secure foundations will be required for them; they are not often required to be used, except in very cold weather.

The bow and stern cradles are very similar in construction and Fig. 16 shows an American form of bow cradle for ships up to 5,000 tons launching weight. The weight of the four cradles and sliding ways amounts to about 3.4% to 4.4% of the net launching weight of the hull. In Fig. 16A, another arrangement of the slidways is shown, the section being taken between the cradles.

Keel Blocks

During the construction of the ship, the keel is laid on pitch pine keel blocks, sometimes with an oak capping piece, the blocks being about 2-ft. wide at th etop and 5 to 6-ft. wide at the base, and 1-ft. thick. The bilges of the vessel are also supported by blocks and numerous timber props outside the sliding ways, bearing on planks laid on the ground. The keel and bilge blocks including the props each carry about $\frac{1}{3}$rd the weight of the ship.

In the case of a large vessel of 30 tons per lin. ft. launching weight, the midship section, allowing for 20% increase in weight, will weigh 36 tons per lin. ft. or 12 tons per lin. ft. on each line of blocks, and with keel blocks 5-ft. apart centres, the load will amount to 60 tons per block, or 30 tons per sq. ft. for the top block 2-ft. by 1-ft. and 12 tons per sq. ft. for the lower 5-ft. by 1-ft. block.

Occasionally, the keel blocks for large ships are arranged in sets of 4 at 2-ft. apart centres, with a clear space of 3-ft. between the next group of blocks to allow a free passage way.

Bilge blocks are usually 20 to 30-ft. apart, as the props take a large proportion of the bilge weight.

The height of the blocks is reduced to a minimum consistent with easy working conditions underneath the ship, and the lower the blocks are made, the better it is for launching.

As the crushing strength of oak is about 430 tons per sq. ft. and that of pitch pine about 400 tons sq. ft., the safe load on each block will be about 40 tons per sq. ft. allowing for a factor of safety of 10, as the wood will crack before the crushing strength is reached The keel and bilge blocks, props and shores are, of course, removed before the ship is launched.

If 20 tons is the safe load on each pile, then for a load of 60 tons per block, 3 piles will be required, spaced 5-ft. apart centres longitudinally, and should the longitudinal spacing of the piles under the groundways be less than this, it will not be possible to put head timbers to the piles right across the slipway.

Piles

The piles are usually of uncreosoted pitch pine from 12 to 14-in. square, and from 30 to 50-ft. long or more, and as the final set or penetration of the pile per blow of the ram, which has been specified, may not be obtained with the length of pile driven, it can be lengthened by cutting off the head, and adding another length, the joint being made with two steel plates 4-ft. long and $\frac{3}{8}$-in. thick, fastened to the pile head and the extra length by bolts 1-in. diameter.

It is most important that there should be no settlement in the groundways, as this would cause the vessel to sag, and perhaps stick on the ways during launching. It is advisable, therefore, to have test piles driven before any permanent piling is done, these should be loaded and the settlement observed; a formula may then be devised for the final "set" to be given, and the maximum load that can be put on the piles, allowing for a factor of safety of two.

Piles in mud and alluvial soils may require to be from 50 to 60-ft. long before the specified penetration per blow of the ram can be obtained, but, in London clay, it is difficult to drive piles more than 20 to 25-ft.

On the heads of the rows of piles, crossbeams are fixed by means of steel spikes, 2-ft. long by $1\frac{1}{8}$-in. diameter, or sometimes oak trenails 2-ft. 6-in. long and 2-in. diameter are used, holes being bored in the cross-beams and partly into the pile heads to receive the spikes; one spike per mile is sufficient. On the cross-beams, a platform of 11-in. by 4-in. or 12-in. by 6-in. planks is laid longitudinally and spiked to the beams; the planks should break joint over the beams. On this platform, the ground or standing ways are built up with baulks of timber to the inclination required, and fastened with spikes and clamp irons. Horizontal timber struts are fixed at intervals of from 6 to 12-ft. between the two lines of groundways, in addition to the timber shores which butt against piles on the outsides of the groundways. The longitudinal spacing of the piles apart, will require to be closer at the lower ends of the ways for about $\frac{1}{3}$rd of the length, because the maximum pressures will occur in this portion, due to the stern of the vessel rising and throwing the pressure on the bow cradles. Sometimes the lateral thrust at the ends of the ways is so great that the groundways are lifted while pressing against the side shores.

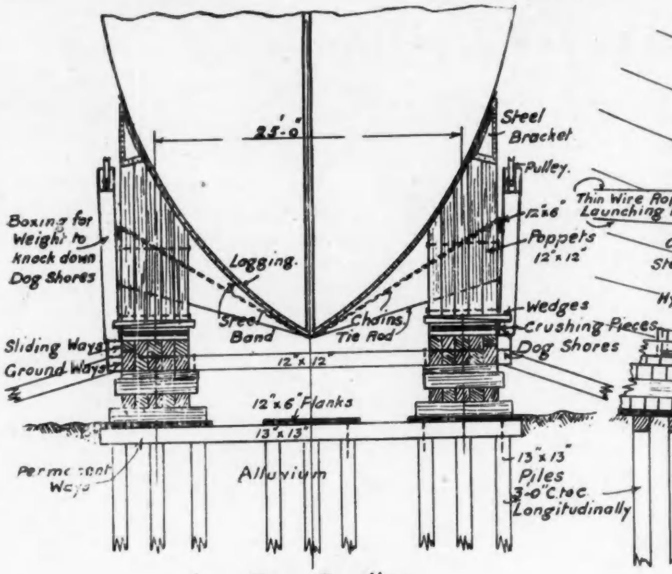
Floating Docks

In the launching of floating docks, the gradients given to the ways vary from $\frac{3}{4}$-in. per ft. (1 in 16) to $\frac{1}{2}$-in. per ft. (1 in 24), according to the total weight to be dealt with. The dead weight of these docks ranges from 31 to 4.26 tons per 100 tons lifting capacity; the average for 10 docks with two side walls is 34.5 tons per 100 tons lifting capacity, and for 10 single walls off-shore floating docks, the average is 37.2 tons per 100 tons lift, the extra weight being due to ballasting. The weights in each case are exclusive of booms and outriggers.

There will be a reduction in the dead weight at launching of about 1% due to the omission of cranes, workshop machinery, dynamos and pumps. In Fig. 17, a cross-section of the ways for a typical floating dock is shown, and details in Fig. 18. The dock is 680-ft. long with side walls 508-ft. in length, with a lifting capacity of 32,000 tons and the weight will be $\frac{32{,}000}{100} \times 34.5$ $= 11{,}040$ tons, less $1\% = 10{,}930$ tons launching weight, and with 4 lines of ways each 2-ft. wide, the average pressure will amount to $\frac{10{,}930}{508 \times 2 \times 4} = 2.68$ tons sq. ft.

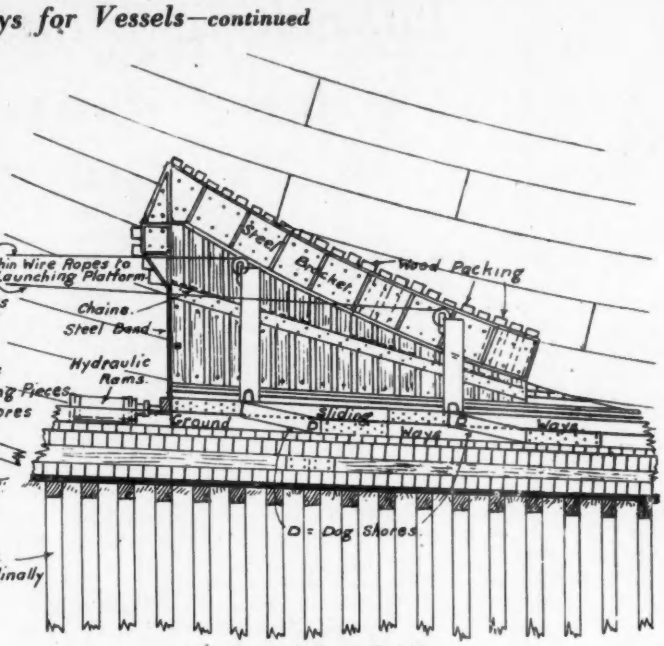
Reinforced concrete caissons of the floating-out type for the construction of harbour walls and piers or breakwaters are

Launching Slipways for Vessels—continued



Bow Cradles.

Fig. 14.



Side View of Bow Cradle.

Fig. 15.

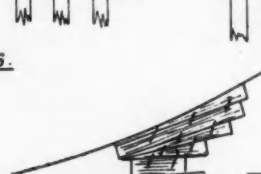
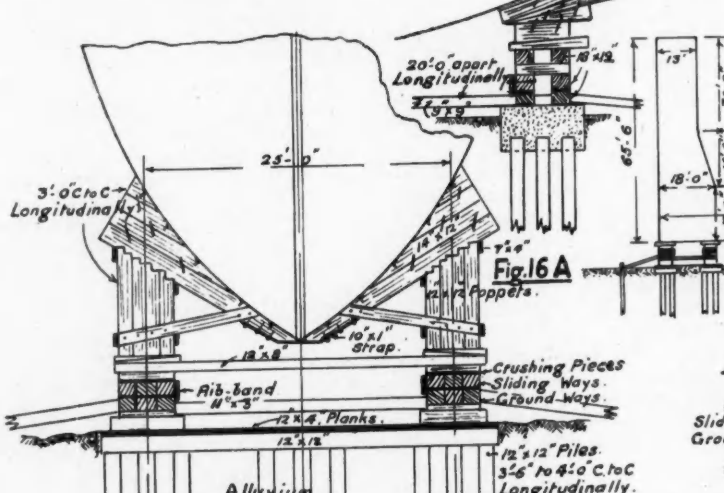


Fig. 16 A



Bow Cradles.

Fig. 16.

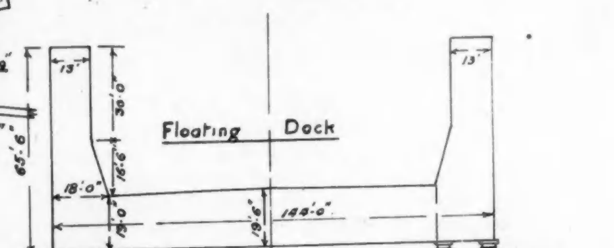


Fig. 17.

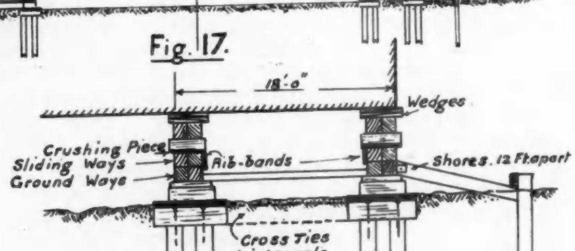
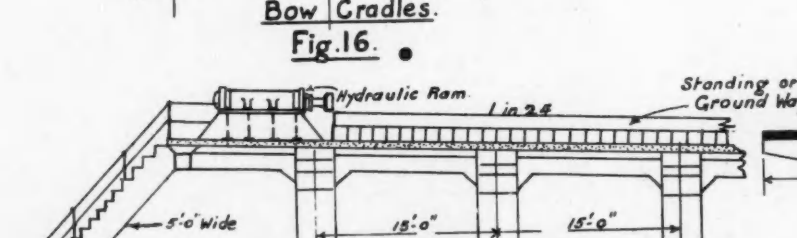
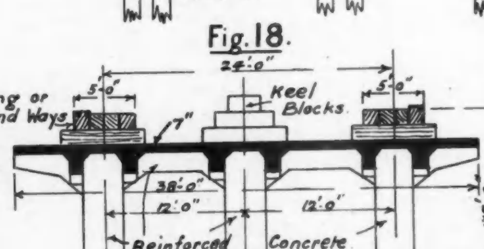


Fig. 18.



Elevation

Fig. 19.



Cross Section.

Fig. 20.

Launching Slipways for Vessels—continued

occasionally launched on slipways having gradients of from 1 in 16 to 1 in 20. The groundways are laid on timber sleepers spaced about 3-ft. apart. Some are built vertically, and others with one side bearing on the ways, in this latter case the open end is closed with a timber bulkhead before launching, and should the ways not be greased the caisson is pulled into the water by hawsers attached to a tugboat. As the base is the heaviest portion, it will immediately right itself in the water provided there is sufficient depth, but the draught of these caissons is considerable, and may be so much as from 15 to 30-ft. so the slipways should be extended some distance into the water. The weight of some of these caissons ranges from 630 to 2,360 tons, or from 10 to 23 tons per lin. ft., and from 32 to 54 lbs., or an average of 43 lbs. per cub. ft. outside measurement, which is about the usual weight.

Caissons constructed of timber are launched on ways having an inclination of 1 in 10.

When the slope of the foreshore is so flat that the fore ends of the ways stand some height above the ground level, instead of building up the groundways with timber blocks to the inclination required as is usually done, the permanent ways may be constructed of reinforced concrete piers and beams or arches as illustrated in Figs. 19 and 20. In this case the ground has a slope of 1 in 50 in a length of 700-ft., giving a rise of 14-ft. at the head, while the gradient of the ways is 1 in 24 with a rise of 29-ft., a difference of 15-ft. height above the ground level. The total weight of the concrete at 15 cub. ft. per ton is 76 tons per 15-ft. bay at the head or 38 tons per pier, and assuming the weight of the ship to be 2 tons per sq. ft. on the ways, the load will be 15-ft. by 5-ft. by 2-ft. = 150 tons, a total of 188 tons per pier, and on a base 6-ft. by 6-ft., this equals 5.22 tons per sq. ft. the subsoil being assumed to be rock.

Should the ground be of an alluvial nature so that piles are necessary, the load on each of 6 piles per pier will be 31.33 tons, which is not excessive.

Pile Driving

The connection with the driving of timber piles, the force of the blow should not exceed 16-ft. tons, or the pile head may be shattered, the body of the pile split in the length, or the bearing on the shoe crushed, so that severe hammering of the pile should be avoided.

The area at the base of the pile, where it bears on the cast iron shoe should be 6-in. square for 12-in. sq. piles and 7-in. for 14-in. piles, and the weights of the shoes for 12-in. sq. piles should be about 40 lbs. for 13-in. piles—50 lbs. and for 14-in. about 58 lbs., although lighter weights are used, which involves blunter points and more difficulty in driving. Should the driving of a pile be stopped for some hours, it will be found that the penetration or "set" per blow of the ram, on restarting the driving will be much less than at the time the driving ceased, the increased resistance being about 2.5 to 1. This is due to the ground closing round the pile and increasing the friction, and after about a month, the bearing power of piles increases from 30 to 50% and in sand up to 300%.

The best results are obtained with single acting steam hammers of the Nasmyth or Lacour types, which deal quick heavy blows, in lieu of the slower method of using $1\frac{1}{2}$ to $2\frac{1}{2}$ ton rams, and 6-ft. fall, hauled up by a steam or electric winch, because in the former case the quick succession of blows keeps the pile on the move, and the ground vibrated, so that there is not sufficient time for the soil to settle round the pile, until the latter has been fully driven. The friction of piles varies according to the nature of the ground, and varies from about 3 to 5 cwts. per sq. ft. of pile surface in mud, to 9 cwts. in silt and clay, 10 cwts. in sand and gravel and 15 cwts. in sand or clay. The closer the piles are driven, the greater is the friction, as the ground is compressed between the piles. When piles are driven below the level of the pile frame or under water, the leaders of the frame are extended, and an oak or elm follower or "dolly" several feet long, is required, and having the ends shod with a mild steel or wrought iron ring 2-in. by $\frac{3}{4}$-in. or 3-in. by 1-in., is placed on top of the pile, the "dolly" has the effect of reducing the force of the blow of the ram to from $\frac{1}{3}$ to $\frac{1}{2}$ that of a direct blow on the pile head the static force or resistance of which is equal to $\frac{W.H.}{S}$ where W = weight of ram, H = fall of ram in inches and S = "set" or penetration of pile into ground in inches.

With regard to steam-driven pile hammers, the first was invented by James Nasmyth in 1844. In this, the rectangular cast iron ram of the pile driver, weighing up to 4 tons, with a 4-ft. fall, fits inside an iron casing which bears on the head of the pile. On the top of the casing is fixed the steam cylinder, with piston and piston rod which is attached to the ram; this is raised by the steam pressure below the piston and when it reaches the top of the cylinder, the steam escapes through holes in the latter near the top, and the ram falls, giving from 60 to 80 blows per minute. The whole apparatus is suspended by a slack chain or wire rope from a pulley at the top of the pile driving frame, the rope being attached to a winch. The steam pipe is flexible and the steam at a pressure of about 80 lbs. per sq. in. can also be admitted or exhausted by hand, by a rope fixed to the valve, or automatically by trip gear attached to the ram.

In the Lacour hammer, the steam cylinder forms the ram; the piston rod and the cylinder, which has a square base, bear on the pile. The steam is admitted through a flexible pipe between the top of the piston and that of the cylinder, thus raising the cylinder, the steam is then exhausted through a valve and the cylinder ram falls, at the rate of from 20 to 30 strokes per minute.

A modern form of this type of hammer consists of a heavy cylinder with a square top and base, which forms the ram, and bears on the pile; the piston rod passes right through the cylinder ends with a stuffing box at the top, the piston being situated about midway in the length of the rod. The lower portion of the rod is solid and rests on the pile, while the upper half is a long tube on which the cylinder slides. Steam is admitted through a valve on the top of the tube, and passes into holes in the top of the piston, thus pressing between the top of the piston and the cylinder and raising the latter. The steam is then allowed to escape through the valve, which is controlled by a hand-operated rope from the ground. The largest hammers have a weight of 5 tons with a 6-ft. fall, and the total weight of the apparatus is 5.8 tons.

Another form of hammer, which may be worked by either steam or compressed air, consists of a rectangular cast iron block weighing in the largest size about 3.34 tons, which is suspended from the pile driver frame by a wire rope, and bears continually on a steel anvil block on the pile head. Inside this casting is a piston 12-in. diameter and over 3-ft. long, weighing 0.36 ton, having a collar midway in its length about 15-in. diameter. This forms the actual double-acting piston in an enlarged bored portion of the block, with a valve box on the outside, through which the steam is admitted and exhausted alternately on each side of the piston collar, so that the piston when it falls, impelled also by the steam pressure, hammers the anvil block on the pile head with a 12-in. stroke at the rate of about 200 blows per minute.

Single-acting hammers of an enclosed type are also used for driving piles below water level, the hammer being submerged, and following the pile down to the river bed. The hammer is guided by the extended leaders of the pile-driving frame, or by a pile at the back driven a short distance into the soil.

Death of Former Dockmaster.

The death has taken place of Mr. Reginald Thomas Skinner, who was formerly Dockmaster of the South Dock at Buenos Aires.

Serious Dock Shed Fire at Liverpool.

Contravening the bye-laws of the Mersey Docks and Harbour Board, which forbid smoking on the dock premises, a dock labourer struck a match near some bales of jute with the intention of lighting a cigarette. The resultant flame ignited the highly inflammable bale and caused a serious fire, involving damage to the extent of £6,329. When arrested, the culprit had live and spent matches in his possession and a dozen cigarettes; he was committed to the Assizes.

Concrete in Sea Water

Author's Reply to the Discussion on his Paper*

By HOMER M. HADLEY, Assoc.M.Am.Soc.C.E.

It is the privilege of the writer to answer, or to attempt to answer, the objections that have been raised to his paper. On the moot subject of concrete in sea water there would probably have been a wider discussion and more objections raised if times were less troubled and more leisurely than now. However, a sufficient amount of scepticism has been presented, directly, indirectly, and by reference, to stimulate the writer to further and closing endeavours, as follows:—

First be it said that the paper attempted to give a summarised but complete statement of facts and conditions as they exist; then an interpretation of those conditions. As to the statement that there are a large number of concrete structures of considerable age in sea water along the Pacific Coast, which are free from deterioration, no denials were entered. On the contrary, Messrs. Stanton, Way and Paxson confirm and endorse these statements, and Mr. Squire, although favouring the chemical attack theory, specifically declares that the substructure of the Ferry Buildings at San Francisco, "approaching its 50th anniversary," is free from deterioration. Therefore, the existence of the numerous old and unaffected structures, not having been challenged or denied, may be accepted as reality by every one. This may be done the more readily because beyond any one's assertion, pro or con, are the structures themselves, standing in place and giving their own testimony to whoever examines them. Mr. Squire appears to feel that conclusions based on a mere quarter century's performance are too hasty and precipitate and that good behaviour for the first 25 years is no assurance as to what may happen in an ominous future; but apart from his warning no dissent on the widespread immunity from sea-water attack has been expressed. It is largely in the interpretation of the deterioration which has occurred that variance of opinion is most pronounced.

Before coming to the other matters, however, the question of the significance of these old and unaffected structures may well be asked. If sea water attacks them why are they immune? If they are immune—and they are—what is the matter with the sea-water attack? Where is it? Why doesn't it attack? In short, where is the reality—in the structures or in the theory that they contradict and refute? Under these conditions the theory manifestly becomes untenable. There is no satisfaction in retaining and cherishing a theory that does not work, however plausible it may be. A prediction of future occurrences must be duly fulfilled if faith and credence are to be maintained in the prediction. Therefore, it appears advisable to the writer that the inevitable sea-water attack theory be abandoned because of altogether too much conflicting evidence. However, should any one be minded like Mr. Squire to retain it for another 10 or 20 years, let him feel wholly free to do so. Time is not an end. Nevertheless, he should bear in mind what was said of old: "Hope deferred maketh the heart sick."

Also deserving of fullest consideration are the partly deteriorated structures—those which combine disintegrated parts with perfectly sound and unaffected parts. Why do they do this? How can such things be? If the sulphates of magnesium, or what-have-you, attack the concrete in some places, why not in others?

It is gratifying to find that there is general agreement on the need for proper mixtures, minimum water content, careful placement, etc. Since the importance of these matters is now widely recognised, it follows that concrete in sea water will have a far better record in the future than it has had in the past.

The dearth of supporting laboratory data in the paper receives adverse comment in two discussions. That such data is most conventional is admitted. It is orthodox, regular, "almost always done." Yet is there need for it as an aid in permitting one to believe the existence of that with which he is confronted? Assuming that the observer stands before concrete that has been exposed to sea water for many years and that he not only sees that it is sound and unaffected but on striking it with a rock or a hammer he likewise feels that it is hard and unyielding and hears it ring to the blow as only hard, sound concrete does, then on this evidence of three of his five senses—all that are involved—it is submitted that without more ado and without waiting for core borings he may well believe that it is indeed unaffected by the sea water. Such may seem a daring, risky, hazardous thing to do on one's own initiative and "without benefit of clergy," so to speak, but inasmuch as there is a wealth of corroborative experience to be had, the act is recommended. If there were not the additional and supporting evidence, physical and chemical analysis would assuredly be most desirable. An extraordinary anomaly deserves the fullest investigation; but this is no rare thing, this unaffected concrete. It is everywhere, even constituting the major part of badly deteriorated structures. Relevant, therefore, appear the words of Lewis Mumford, who can see no need for research to prove that water is wet or that pepper tastes hot on the tongue. There is nothing particularly wrong with such research, of course, but why, laboriously and scientifically, demonstrate the obvious? What is needed far more than any laboratory research or cutting of cores is a comprehensive and detailed survey and report on conditions as they exist, supported with ample photographic evidence. Every one could then form his own conclusions from the photographs—and there would be little to argue about. In general, the cause of sea-water attack is no more than this: Too much water in too lean mixtures frequently assisted by careless replacement. Change these conditions and the attack disappears. Retain these conditions and the attack follows. "Pay your money and take your choice."

Several advance the suggestion that where deterioration does occur the sea-water sulphates hasten and accelerate the destruction. Possibly this is true—possibly it isn't. What quantitative data exist to support the hypothesis? For many years the writer has looked at concrete—good, bad and indifferent—not only in sea water but in fresh water as well, and he can only say that his impression is that the deterioration is substantially alike, allowance being made for the greater water movement and greater mechanical destruction along the sea coasts. Following Mr. Hammond's reference to them, the writer re-read the articles[1] by Messrs. Wig and Ferguson published in 1917, and he looked at the illustrations of these articles. Then he looked through a dozen or so volumes of the *Proceedings* of the American Concrete Institute (A. C. I.), which have carried many a paper and report about durability of concrete, deterioration of concrete, frost-resistant concrete, etc., principally illustrated with examples in the Great Lakes region. For every Wig and Ferguson illustration of sea water deterioration—reinforcement troubles excepted—he thought he found its counterpart illustration of structures around the Great Lakes, far from the sulphates of magnesium. Also, let every one who would make sea-water resistant concrete read a Paper by R. B. Young,[2] published in 1940. It presents the recipe although not written with that thought in mind.

Captain Blackman and Mr. Freudenthal advance the view that the making of proper concrete for sea water use is a matter of delicacy and extreme refinement. "A hair, perchance, divides the false from true." To which view the writer must dissent. Given reasonable proportions and control there is no cause for believing that a slight departure from the established quantities is fraught with dire consequences. If water is kept to the minimum which placement will permit, and if the cement content is not less than 1.50 bbl per cu. yd., considerable fluctuations can occur without ill effects. They are not recommended, of course, but neither should they be appalling to contemplate if they do occur.

Of all the evidence in support of the sea water attack theory, the writer knows of nothing more convincing than tests described by Mr. Stanton[3] in 1938. He has seen these specimens with his

*Published in the June, 1941, issue of "The Dock and Harbour Authority" and followed by the Discussion in subsequent issues; reproduced from the Proceedings of the American Society of Civil Engineers.

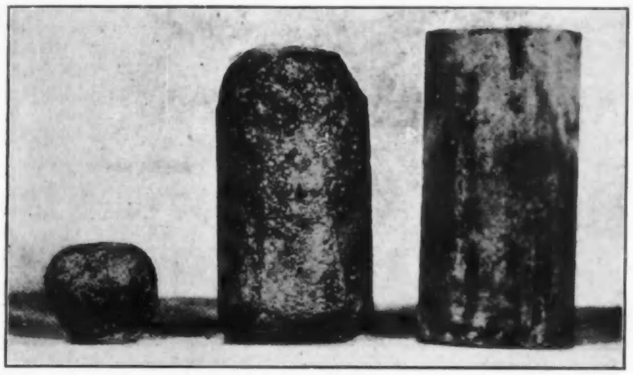
[1] "Engineering News-Record," Vol. 79, Nos. 12, 14, 15, 16 and 17.

[2] "Frost Resistant Concrete," by R. B. Young, 1940, p. 477.

[3] "Testing Cement Mortars in Sea Water," by Thomas E. Stanton, M.Am.Soc.C.E., "Engineering News-Record," March 17th, 1938, p. 400.

Concrete in Sea Water - *continued*

own eyes and accepts the findings without hesitation. There is clearly demonstrated by immersion (not in some other alkaline water but by immersion in sea water itself) the fact that pronounced differences in these specimens develop between cements of high and low C_3A-content. Figs. 1 and 2 are views of certain of Mr. Stanton's typical specimens at the age of 4 years. There is no question as to the way in which the test specimens have



a. Standard Ottawa Sand; 1 ; 3 Mix *b*. Standard Ottawa Sand: 1 ; 2 Mix *c*. Graded Russian River Sand: 1 ; 3 Mix

Fig. 1.—Variations of Mix: Cement Specimens After Four Years in Sea Water (17.2% C_3A).

behaved. However, Fig. 3 of pier 17 on the San Francisco water front, built in 1912, is highly relevant to the conclusions that are to be drawn from Mr. Stanton's investigations since it is built of that same brand of cement used in the tests which was found to have 17.2 C_3A-content and to have the poorest resistance to sea water of any of the cements tested. Despite this fact, the piles of pier 17 are unaffected by sea water and the little fins that formed at the joints in the forms still project from their surfaces. Inevitably the question arises: "So what?"

It is to be recognised by every one that the same name on a sack of cement does not mean identical cement from year to year unless raw materials and manufacturing processes remain unchanged. However, no change of major consequence has occurred with this particular brand of cement. It uses the same limestone and same clay and essentially the same manufacturing process to-day as it did in 1911 and 1912. Its raw materials are more carefully proportioned, more finely ground, and are better controlled; the burning is better controlled; the clinker is more finely ground. Beyond these changes, however, the manufacturing process is substantially unaltered. It can safely be assumed, therefore, that the cement of pier 17 is practically the same as that used in Mr. Stanton's tests. Other differences, therefore, must account for the extraordinary contrasts in behaviour. These other differences are immediately apparent in the contrasting mixtures and contrasting specimen structure that results. In the one case a highly permeable porous structure was sought and obtained with mortars using sand of practically uniform particle size. In the case of pier 17 a concrete mixture with its aggregate particles grading from fine to coarse was used.

There are other differences also—those of shape, form and size. A 2-in. by 4-in. cylinder, although a very convenient laboratory specimen, resembles nothing that is built in structures; on the contrary, it is quite unlike anything so built. How great these differences are shown in Table 1, in which are to be noted particularly the curvature (Col. 4) and surface-to-volume (Col. 5) and edge-to-volume (Col. 6) ratios. The little cylinder is much more unfavourably shaped than is the corresponding round pile or square pile section. The square pile has more edge length—chamfered—but has flat plane surfaces.

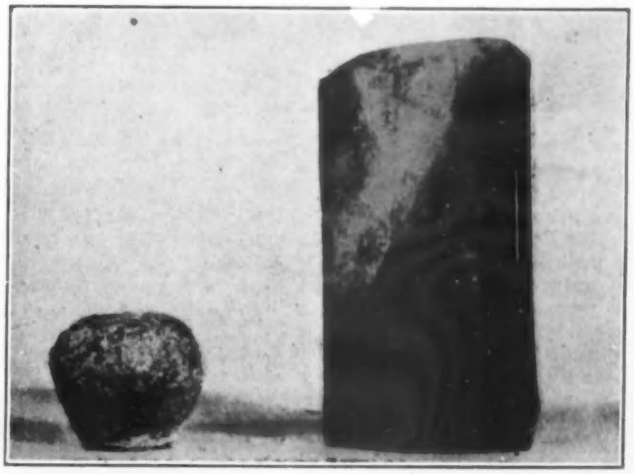
TABLE 1.—RELATIVE SHAPE AND SIZE OF CONCRETE SPECIMENS

Description	Volume (cu in.)	Surface (sq in)	Edge length (in.)	Curvature*	Col. 2 Col. 1	Col. 3 Col. 1
	1	2	3	4	5	6
2-in. by 4-in. cylinder...	12.57	31.416	12.57	57.30	2.50	1.00
4-in. section of 16 in. round pile	804.04	201.06	0	7.16	0.25	0
Ratio, 2-in. by 4-in. cylinder to pile...	....	....	....	8	10	∞

*Curvature of edge and side, in degrees per inch.

There is not only pier 17 at San Francisco in conflict with Mr. Stanton's and others' findings regarding C_3A-percentages. Mr. Squire records the 11% C_3A of the unaffected San Francisco Ferry building substructure, which has been nearly 50 years in sea water. The cylinder substructure of pier 38 at San Francisco built in 1909, the base of the lighthouse on the San Pedro breakwater at Los Angeles built in 1910, the cylinder shells of pier 8, Puget Sound Navy Yard at Bremerton, built in 1911 are all 30 or more years old, are all perfectly sound and unaffected by sea water, although the cylinders of pier 38 contain numerous honeycombed areas dating from their original construction. They were built of that brand of cement which in Mr. Stanton's tests was found to have 13.2% C_3A-content. Average analyses of bin samples of this cement for the years 1909 to 1913 ranged from a low of 14.5% to a high of 15.9% C_3A-content. Moreover, Mr. Stanton advises that his specimens made with high C_3A cement but with the graded Russian River sand still showed no signs of attack after seven years of the same complete immersion in sea water that proved so disastrous to the specimens made with Ottawa sand. It is for these reasons that the writer is unable to attach more than minor significance to the C_3A-content of cement for sea water use. It certainly is important in 2-in. by 4-in. cylinders made of Ottawa sand; but what further claims are (by evidence) warranted concerning it? The disparity between 2-in. by 4-in. cylinders and ordinary piles is great, but how much greater is the disparity between 2-in. by 4-in. cylinders and 4-ft. cylinders, 8-ft. cylinders, small bridge piers, large bridge piers!

The differences may become of wholly different orders of magnitude. The matter of concern is the behaviour of the structure and the prototype. Therefore distinctions which by a process of magnification, are made manifest in a laboratory appear to the writer to have little significance unless they are also found in the prototype; and if they reveal no effect in the prototype, what practical importance attaches to them?



a. 17·2 per cent. C3A *b*. 7·2 per cent. C3A

Fig. 2.—Variations of C_3A-Content; Cement Specimens After Four Years in Sea Water (Standard Ottawa Cement; 1 : 3 Mix)

Mr. Way's detailed account of experiences with a large new concrete pile job and of what was found on examination of a near-by pile structure, 15 years old, is a valuable one, particularly in its bearing on the importance of transverse cracks in concrete piles. Frequently a great deal of alarm, agitation, and trouble to all concerned result from fine shrinkage cracks in piles which, if the concrete is of proper quality, cause no harm whatsoever. It is not true that the mere admission of sea water through fine cracks to the reinforcement inevitably brings about progressive rusting of that reinforcement and disruption of the enclosing concrete. If the concrete is (or was) of a lean, wet mix, such very probably will be the result; if the concrete was not lean and not wet, nothing of the sort will happen. A few miles west of Olympia, Wash., in 1920, a small concrete bridge was built across

Concrete in Sea Water—continued

the head of Mud Bay, the southern-most tip of Puget Sound. The columns of the bents were poured in place. At high tide they are almost completely immersed in sea water. At low tide they are completely bare. At a number of places on the square, chamfered corners of these columns, drift logs have broken off the concrete, exposing the main vertical reinforcing bars for several inches. These exposed lengths, of course, are heavily rusted; but no progressive rusting lengthwise along the bars or splitting of the concrete has ever resulted. The rust formed to the edges of the concrete and stopped there. The writer makes this statement with the greater assurance because he broke off some of the abutting concrete, further exposing the reinforcement, and saw that the rust stopped at the edge of the original fracture. Why should this be, if the admission of sea water through the least fine shrinkage crack means doom and perdition? Well, it means no such thing.

Fig. 3.—Precast Concrete Pile Jackets; San Francisco Pier Built in 1918.

An interesting case showing the effect of too much water is in the San Francisco district where considerable corner cracking over the main longitudinal bars occurred in a large pile job, necessitating rather difficult and extensive repairs. The piles, as is always the case, were cast in a horizontal position. Three of their sides were thus poured against forms; their top sides were troweled. When the cracks developed, in practically every instance they occurred on the troweled side of the pile—that is, on what had been the top side. " Water gain "—a fine film of water on the under side of the top longitudinal bars, which water film later left an equally fine void space wherein rust could form and progress—appears to be the explanation of this case. Bond tests by H. J. Gilkey, M.Am.Soc.C.E., S. J. Chamberlin, Assoc.M.Am.Soc.C.E., and R. W. Beal[4] and by Carl A. Menzel show strikingly the effect of casting position—" orientation." It is also worth recording here that the very unfortunate and widely-celebrated early experiences with concrete piles in the work of the Los Angeles Harbour Commission were had with piles of 1:2:4 mix, some of which at least (as photographs attest) were cured by a man sprinkling them with a hose; how continuously or how intermittently is not revealed by the photographs.

Mr. Paxon's comments on sea-water concrete along the Oregon coast are appreciated. His observation that concrete in deep water shows less deterioration than that on the shore where abrasive and scouring action occurs is highly significant and amusing as well: The more completely the sulphates of magnesium surround the concrete the freer it is from deterioration.

To Mr. Hammond the writer would refer his preceding discussion of Mr. Stanton's tests. He would question Mr. Hammond's statement that Messrs. Wig and Ferguson " demonstrated " that chemical action was noted all along the Pacific Coast. Their papers published in 1917 reveal that they found a considerable amount of deteriorated concrete. The interpretation they placed upon it was that the deterioration resulted from sulphate attack. Presumably they examined all of the old concrete structures shown or referred to by the writer since they state[5] that their examination had been made in the preceding 2 years and that they had made "personal examination of nearly every concrete (marine) structure . . . in the United States." Nevertheless, having reread their papers, the writer cannot see that they "demonstrated" sulphate attack. They attributed the deterioration to sulphate attack. It would be very interesting, however, to see how well their theory of immunity to sea-water attack achieved by the formation of lime carbonate near the outer surfaces of the concrete would be sustained by little 2-in. by 4-in. Ottawa sand specimens that were given proper initial curing followed by generous air curing, and what, under these circumstances, the effect of varying C_3A would be.

Mr. Csanyi's discussion, reporting the condition curvey of nineteen structures in New York Harbour, is very interesting. Regarding the continuously submerged parts of concrete structures that cannot readily be examined, it is to be said that little or no question has ever been raised about them. It appears to be the general experience that this concrete does not deteriorate. When the piers of the Seaside Bridge of the Union Pacific Railroad were removed from Cerritos Channel, Los Angeles Harbour, in 1934, after 26 years of immersion, they were found to be wholly unaffected. They were built of a 1½:3:5 mix, not 1:3:5 as so frequently and so unfortunately has been done in the past. Not a bad spot in them," declared the superintendent of Merritt-Chapman-Scott Corporation who took them out. The concrete fragments from the piers certainly confirmed this statement. When the old bridge at the site of the new Purdy Bridge, Pierce County, Washington[6] was taken out, its foundations had been in sea water for 15 years. One of the piers had to be removed completely. Its concrete throughout was found to be in perfect condition and its reinforcement clean and without rust.

The rigour of Mr. Csanyi's refutation of the writer's contention is lessened and abated by the fact that his studies, experiments, and conclusions are based not on behaviour of test specimens in sea water, but on their behaviour in a 43% solution of Epsom salts. It would appear to the writer that they are highly relevant to concrete that is to be given such exposure, but that the relationship of the 43% Epsom salts solution to sea water has not been established. Pending that determination the writer will continue " in the error of his ways," if such it be.

Professor Williams' brief discussion is charged with numerous doubts. Regarding chemical analyses, the subsequent discussion of two subjects referred to by Mr. Squire will be pertinent. As to Professor Williams' statement that " Rich concrete mixtures may fail by cracking without prior indication of surface swelling, spalling, or disruptions," the writer would enquire if he (Professor Williams) has ever seen this happen with rich concrete mixtures, not in other alkaline waters, but in sea water. If he has, it is to be hoped that full particulars may be reported, for assuredly it is a highly unusual, not to say unique, occurrence, the like of which has not come under the writer's observation. The terms dense and impermeable in the paper were not used academically but as they are commonly employed. The writer disclaims any responsibility for establishing the criteria by which the sulphate attack of sea water upon concrete is supposed to evidence itself. Messrs. Atwood and Johnson quoted E. Candlot who attributes the sea-water sulphate attack theory and its supposed manifestations to L. J. Vicat. The writer merely assumed (see heading " The Prevailing Viewpoint ") that if the theory were valid the evidences of the attack should be discoverable. The paper purports to be no more than an unequivocal statement that such evidence is not to be found along the Pacific Coast and a

4 " Bond Between Concrete and Steel," by H. J. Gilkey, S. J. Chamberlin and R. W. Beal, " Bulletin," No. 147, Eng. Experiment Station, Iowa State College, Ames, Iowa, 1940.

5 " Engineering News-Record," September 20th, 1917, p. 532.

6 " Engineering News-Record," March 3rd, 1938.

Concrete in Sea Water—continued

report of what deterioration is to be found. Also, it was stated at the outset: . . . " it is with sea water in its normal range of concentrations not with other sulphate waters—that the paper is concerned " (see " Introduction "). It was not without knowledge of much to the contrary that has been published earlier that this paper was written. Despite that knowledge, it was written, quite deliberately.

Mr. Squire raises a number of points. One of these concerns the San Pedro breakwater specimens referred to in the paper, the cutting of cores from which, and the saturated condition of the interior concrete of which, on the basis of his " visual " and therefore, by his stern standards, very questionable inspection only, are attested to by Mr. Squire. What the result of the Bureau of Standards' tests and analyses might be was naturally an interesting question. The blocks gave every outward evidence of being all right but were they so in full reality? " Gilded tombs do worms enfold." One of Mr. Squire's fellow citizens in the Bay region who had read the magazine article cited[7] wrote to the U.S. Engineer office at Los Angeles and duly received a reply concerning the findings. When the writer made personal enquiry at the office, he was shown a copy of this letter, which was quite in accord with other information he had received. There was nothing about the findings to make them of a confidential nature, and there appears to be no good reason why they should not be summarised herein from notes made at the time.

The Bureau of Standards felt that the tests were inconclusive, principally because the cores were of small diameter (3-in.). Tests were made of eleven cores—five of 1:2:4 mix and 6 of 1:3:6 mix. Six brands of cement had been used—three European and three American. The maximum size of aggregate was 2-in. The cores were sawed into cylinders, 3-in. high, which were first tested for strength and then analysed chemically. Strengths varied widely. Values with the 1:2:4 mix ranged from 6,650 to 3,110 lbs. per sq. in. Values with the 1:3:6 mix ranged from 7,650 to 1,630 lbs. per sq. in. No signs of disintegration were noted in the broken cylinders. The report pointed out how the low strengths and erratic values were readily accounted for by the varying position and size of the coarse aggregate particles in the cores. It did not attempt to explain how, after 27 years in the tidal zone surrounded by sea water sulphates, the high values found could occur. Chemical tests were made with specimens of five of the six cements, two of which were in 1:2:4 mix cores, the other three being 1:3:6 mix cores. There were six samples of the former and nine of the latter. The tests were to determine percentages of magnesia, sulphuric anhydride, and chlorine. Chemical analyses were stated to be inconclusive because of inability to secure representative samples from the small quantity of material in the cores. The samples of 1:2:4 concrete showed a 74% increase in magnesia content accompanied by a 19% decrease in SO_3-content, which decrease is not in good form chemically when concrete is disintegrating. The samples of 1:3:6 concrete showed a 358% increase in MgO accompanied by a 51% increase in SO_3. In considering the numerical magnitude of these percentages it must not be overlooked that they are percentages of original very small quantities. Regarding the samples of two of the three cements used in the 1:3:6 mix specimens the report stated: " While B—1 and B—4 would seem to indicate that some magnesia from sea water has replaced part of the original lime of the cement, this fact may be solely one due to the question of sampling. There apparently has has been no increase in the SO_3-content, which is what should accompany this disintegration." The view was expressed (let borers of cores and takers of small samples give heed) that 2 to 3 cu. ft. of material were needed to make a satisfactory sample.

Inasmuch as there was no definite evidence of physical or chemical deterioration—which is entirely in accord with the many structures referred to—the writer feels quite warranted in stating that there was " no evidence of sulphate of magnesium attack." He feels further confidence in " what is going on under the outer skin of concrete " if this " outer skin " itself withstands scrutiny.

(To be continued)

7 " Western Construction News," June 25th, 1932, p. 367.

Dublin Port and Docks Board

Excerpts from Report for the Year 1941

There were 53 meetings of the Board and 168 meetings of committees within the year.

Postponement of Election

Owing to the difficulty in finding persons possessing the necessary qualification as shipping members of the Board and having regard to the expenses involved in the preparation, revision and printing of electoral lists, the Board made application to the Government for legislation to postpone the annual election.

To meet this situation, the Government made an Order entitled Emergency Powers (No. 121) Order, 1941, postponing until January, 1943, the election due to be held in January, 1942, and continuing in office for one year those members due to retire in 1942.

The Order also provided that no revision of the list of electors of elective members of the Board should be made in 1941.

Harbour Rates (Port of Dublin) Order, 1941

The above Order made by the Minister of Industry and Commerce on the 11th day of December, 1941, increased the statutory maxima for tonnage rates, good rates and lying-up charges by 33⅓ per cent.

Revenue

The Statement of Accounts for the year 1941 shows a gross revenue of £234,870 6s. 8d.. an expenditure chargeable to revenue of £265,388 4s. 0d. and a deficit of £30,517 17s. 4d.

The receipts from Tonnage Dues and Dues on Goods amounted to £134,437 3s. 2d., being a decrease of £55,025 5s. 7d. as compared with the year 1940.

Loans

During the year an issue of £130,000 Dublin Port and Docks Board 4% Redeemable Stock was made at 99 per cent. bringing the total amount of this stock issued to £400,000.

The loans outstanding at 31st December, 1941, amounted to £1,611,607 2s. 6d., the balance to the credit of the Sinking Funds at that date being £349,279 12s. 8d.

During the year £2,460 of the Board's 3½% Redeemable Stock was purchased and extinguished.

Engineer's Report.

Marine Survey.—The annual survey of the Channel and Bar was completed and disclosed a tendency towards a decrease in depth in some sections following upon the reduced dredging programme.

New Works.—The second section of the Ocean Pier at the East end of Alexandra Quay, 110-ft. in length, was completed making a total length of 280-ft. of quay wall built under this scheme. The reconstruction of Custom House Quay was commenced and the coffer damming and excavation of the first 100-ft. West of Commons Street almost completed.

East Wall Reclamation.—Approximately 1½ acres were filled and 9 acres levelled by the Dublin Corporation during the year.

Great North and South Walls.—The usual annual repairs were carried out on the Great South Wall during the summer. Repairs to the sea wall at the North Bull were also carried out.

The fact that goods made of raw materials in short supply owing to war conditions are advertised in this Journal should not be taken as an indication that they are necessarily available for export.